ENERGY ENGINEERING ANALYSIS PROGRAM

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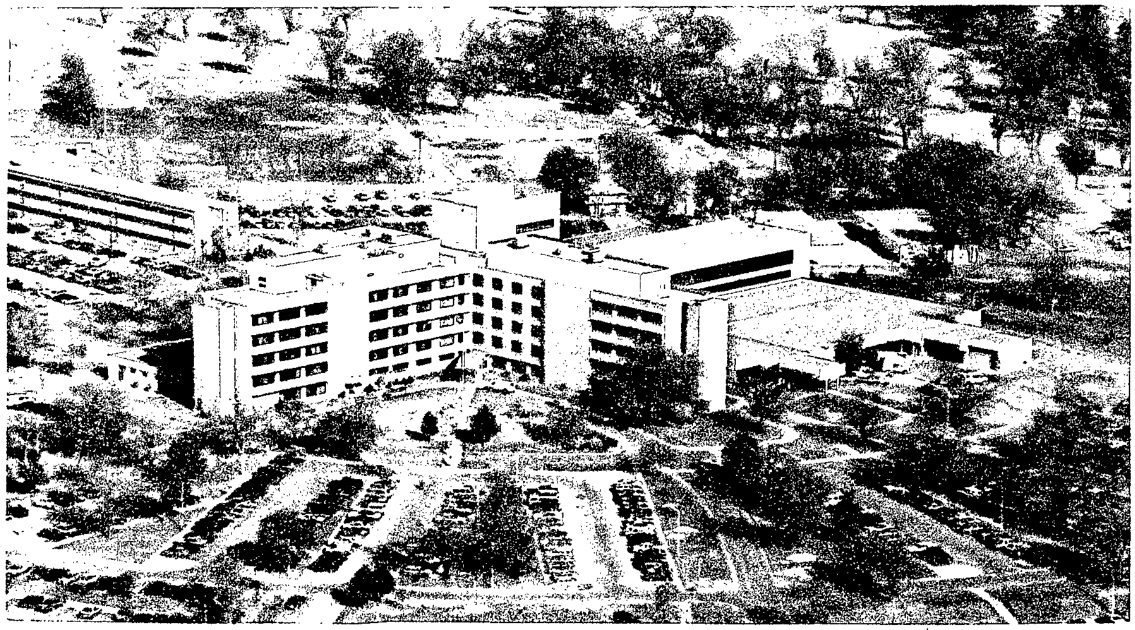

IRWIN ARMY COMMUNITY HOSPITAL
FORT RILEY, KANSAS

PREPARED FOR

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT
CORPS OF ENGINEERS
CONTRACT NO. DACA41-90-C-0114

PREPARED BY

MASSAGLIA.NEUSTROM.BREDSON, INC.
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

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VOLUME 2 OF 3
NARRATIVE
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DEPARTMENT OF THE ARMY
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FINAL SUBMITTAL REPORT DOCUMENTS

For convenience, final submittal report documents are bound in three volumes. Final submittal report documents consist of the following:

VOLUME 1 OF 3: EXECUTIVE SUMMARY

VOLUME 2 OF 3: NARRATIVE

VOLUME 3 OF 3: PROJECT DOCUMENTATION

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SECTION I - INTRODUCTION

SECTION I

INTRODUCTION

1.1 GENERAL:

A. This report covers the Prefinal Submittal for Study of Irwin Army Community Hospital Energy Engineering Analysis Program, Fort Riley, Kansas.

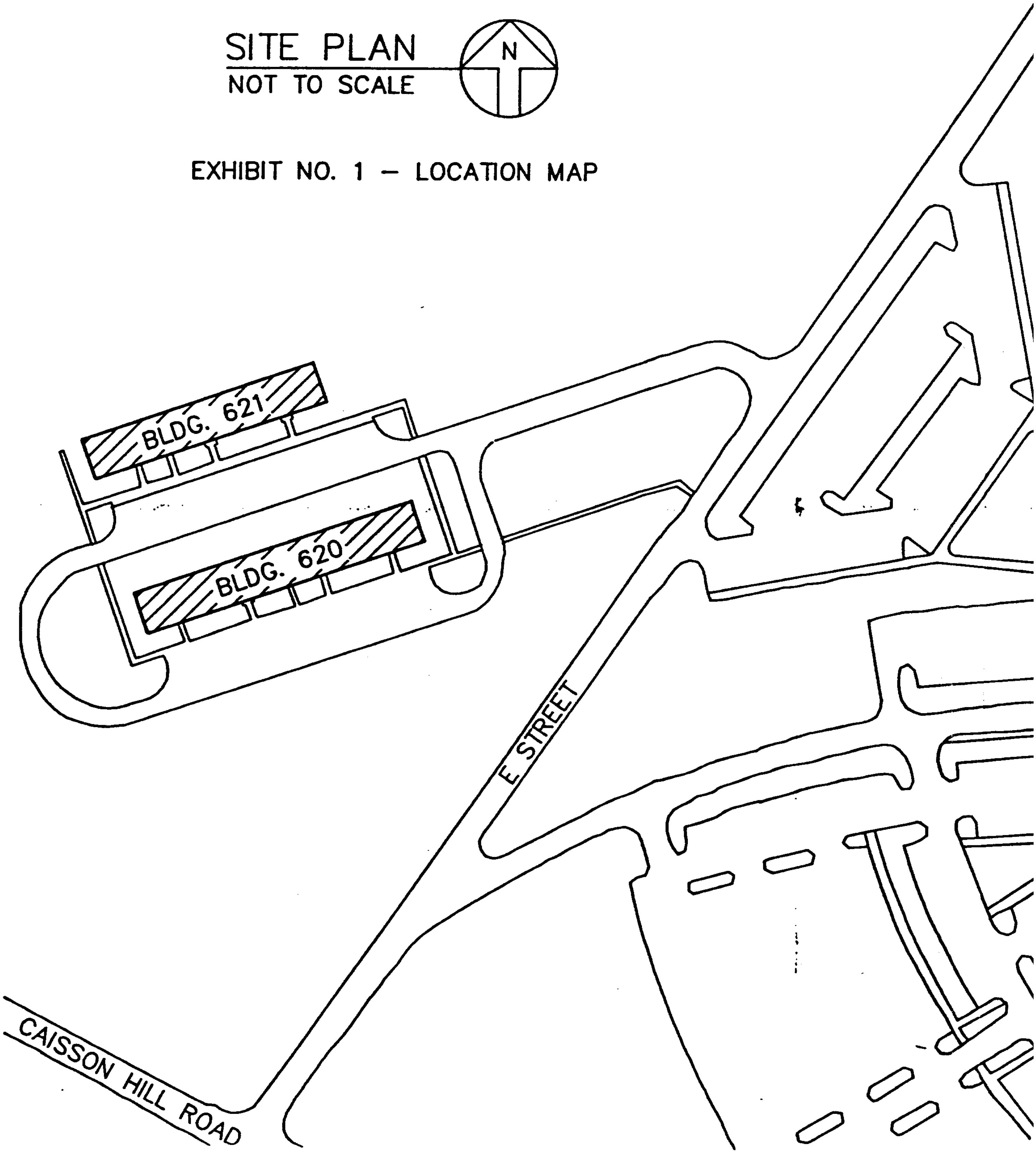
B. Generally, this project consists of conducting and analyzing a coordinated energy study, including a detailed energy survey of the entire hospital facility while integrating any available prior or on-going energy conservation studies. Included in this study are the Hospital (Building 600), the Energy Plant (Building 615), Nurses Quarters (Building 610), family housing barracks Barnes Hall (Building 620) and Kimball Hall (Building 621). Illustrated in Exhibit No. 1 is the site plan showing the general location of the five buildings in the hospital complex.

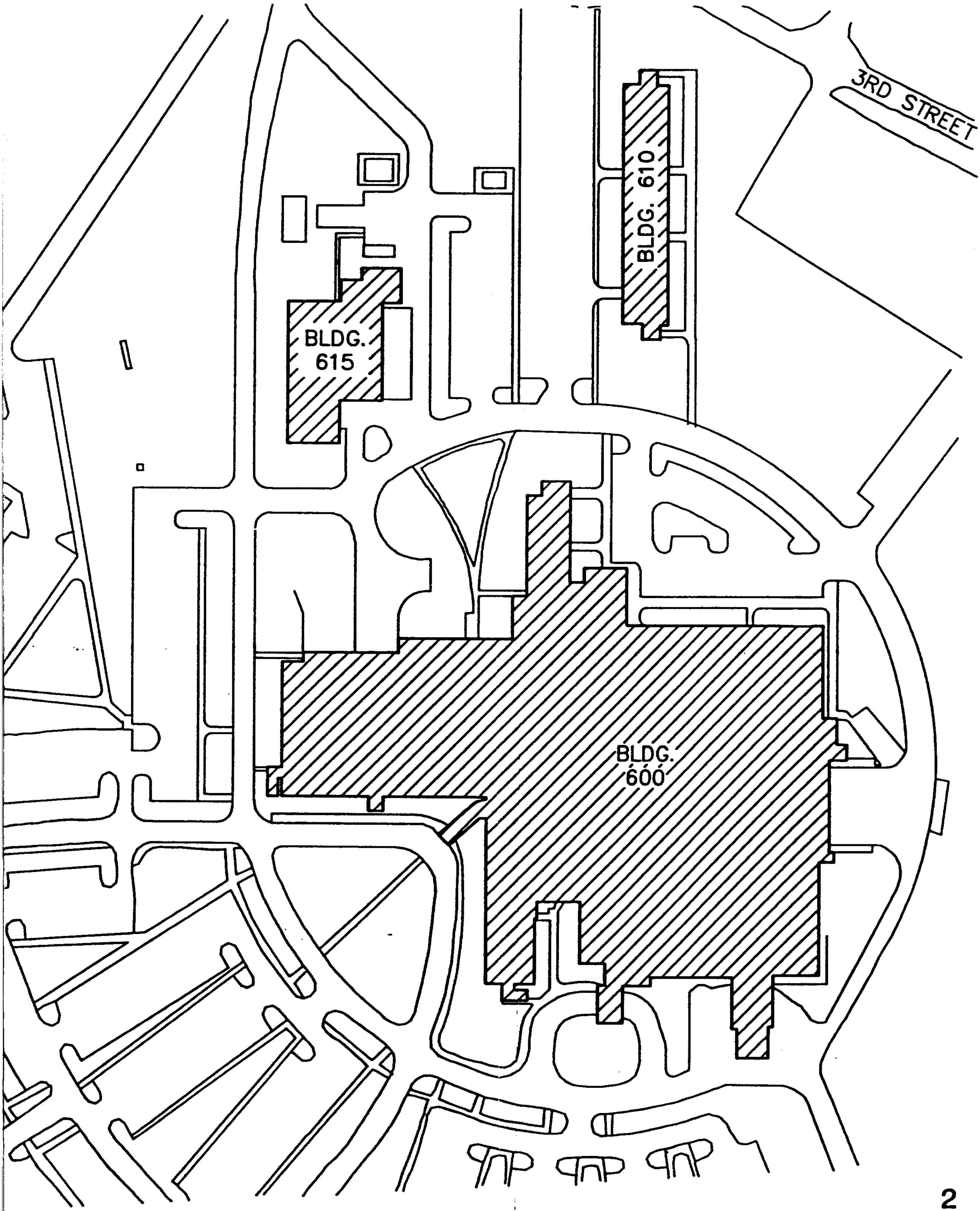
C. The study and report will be conducted and submitted in three phases as follows:

1. Interim Submittal: Submitted May 3, 1991 after completion of the field survey analysis of all identified Energy Conservation Measures (ECO's).

SITE PLAN
NOT TO SCALE

EXHIBIT NO. 1 — LOCATION MAP




3RD STREET
BLDG. 610
BLDG. 615
BLDG. 600

Calculations were performed to show energy and dollar savings including simple payback period and savings to investment ratios (SIR's) for the purpose of packaging and/or combining ECO's for development of a long range energy saving plan for the hospital complex. Review conference for the interim submittal was conducted on July 16, 1991 at Fort Riley, Kansas. Annotated review comments from this conference are included in this volume.

2. Pre-final Submittal: Submitted in September 1991, after review of interim submittal and inclusion of all reviewers comments. This report was a continuation of the study and analysis of the recommended ECO's. The calculations in this pre-final submittal reflected the interaction of the prioritized ECO's recommended for analysis. Life cycle cost analysis was performed on all selected ECO's and implementation documents for all recommended projects were developed. Review conference for the pre-final submittal was conducted on November 26, 1991 at Fort Riley, Kansas. Annotated review comments for this conference are included in this volume.

3. Final Submittal: Report will reflect any revisions or corrections resulting from comments of reviewers. This report includes the completed Form 1391 and/or Form 5108R for final implementation documents on all recommended projects.

1.2 AUTHORIZATION:

A. The Energy Engineering Study and Analysis of Irwin Army Community Hospital, Fort Riley, Kansas is authorized by contract number DACA41-90-C-0014 dated 30 September 1990.

1.3 SCOPE:

A. Scope of work includes government defined scope as indicated in Annex "A", Annex "B", Annex "C", Annex "D", and the following specific tasks:

1. Survey and investigate the Hospital, Energy Plant, Nurses Quarters, Family Barracks, and interior and exterior building systems and utilities.

2. Obtain available record documents and as-built drawings of the hospital complex for use in the study.

3. Interview operating personnel and personnel familiar with the hospital complex to gain information about specific systems, building operating schedules, personnel schedules, building usage, etc.

4. Develop computerized energy model of existing five building hospital complex utilizing the "TRACE" program. The computer model was constructed using inputs from the building drawings, data gathered from

the site visits and information from building operating personnel at Fort Riley, Kansas.

5. Collect and analyze utility data to ascertain the present levels of gas and electricity consumption.

6. Identify and analyze all possible Energy Conservation Opportunities (ECO's) in and around the five building hospital complex. Analysis to include energy savings, dollar savings, cost of implementation, simple payback period, savings to investment ratio and life cycle cost analysis.

7. Recommend Energy Conservation Opportunities (ECO's) for energy programming implementation.

8. Develop final documents for ECIP, QRIP, OSD PIF, PECIP, OR MCA energy programming implementation. documents to include Form 1391 and Form 5108R.

B. Exhibit No. 2 - Annex "A", dated 1 June 1990 and revised 26 September 1990, outlines the general scope of work for this project and identifies possible Energy Conservation Opportunities to be considered for the five building hospital complex.

C. Exhibit No. 3 - Annex "B" is the required DD Form 1391 data to facilitate ECIP project approval.

EXHIBIT NO. 2

1 June 1990
Rev: 26 September 1990

CEMRK-ED-MF

APPENDIX A

This Appendix A supplements Item 6 of Standard Form 252 and delineates the services to be performed by the Architect-Engineer under this contract.

ENERGY SURVEY FOR THE IRWIN ARMY COMMUNITY HOSPITAL

AT

FORT RILEY, KANSAS

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

GENERAL SCOPE OF WORK FOR THE
IRWIN ARMY COMMUNITY HOSPITAL
AT FORT RILEY, KANSAS
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

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1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Perform a complete energy audit and analysis of the entire hospital facility.

1.2 Identify all Energy Conservation Opportunities (ECOs) including low cost/no cost ECOs and perform complete evaluations of each.

1.3 Prepare programming documentation for all Energy Conservation Investment Program (ECIP) projects [DD Form 1391, life cycle cost analysis summary sheet with backup calculations and Project Development Brochure (PDB)].

1.4 Prepare implementation documentation for all justifiable energy conservation opportunities.

1.5 List and prioritize all recommended energy conservation opportunities.

1.6 Prepare a comprehensive report which will document the work accomplished, the results and the recommendations.

2. GENERAL

2.1 A coordinated energy study, including a detailed energy survey, shall be accomplished for the entire hospital facility. The study shall integrate the results of and any available data from prior or ongoing energy conservation studies, projects, designs, or plans with work done under this contract. This Scope of Work is not intended to prescribe the details in which the studies are to be conducted or limit the AE in the exercise of his professional engineering expertise, good judgment or investigative ingenuity. However, the information and analysis outlined herein are considered to be minimum essentials for adequate performance of this study. The study shall include a comprehensive energy report documenting study methods and results.

2.2 All ECOs recommended shall comply with all current criteria for medical facilities. This criteria includes the Joint Commission on Accreditation of Hospitals (JCAH), Occupational Safety and Health Act (OSHA) and the National Fire Protection Association (NFPA) Life Safety Code. This criteria has changed significantly since the hospitals were constructed. In many cases the current criteria will allow reductions in outside air quantities, ventilation rates, and similar items, resulting in significant energy savings.

3.1 Audit. The audit consists of gathering data and inspecting the facilities in the field. These activities shall be closely coordinated with the Government's representative, the Director of Engineering and Housing (DEH), and the Hospital Commander. The AE shall become thoroughly familiar with each hospital facility and undertake all necessary field trips to obtain required data. The AE shall document all field surveys on forms developed for the survey, or standard forms, and submit the completed forms as part of the report. Data sources shall be identified and assumptions clearly stated and justified.

3.1.1 Boiler plants, chilled water plants, kitchens, incinerators, and similar facilities listed in Annex D that are associated with the hospital shall be included in the study. They shall be studied to determine the condition of existing equipment, efficiency of boiler plant equipment, operational procedures, adequacy of plant capacity, and heat recovery possibilities in addition to the general items listed.

3.1.2 During the audit process, promising applications of solar energy shall be identified. A short discussion of these applications shall be included in the report with recommendations for a detailed study. Quantitative analysis is not required.

3.1.3 Data collected during the audit shall be in sufficient detail to identify each air handling system and zone, areas served, supply, return and exhaust air quantities, temperatures and relative humidities, lighting levels and similar data. Area and system air quantities, temperatures, etc., shall be based on measurements made during the audit and not on "as-built" drawings. All test and/or measurement equipment shall be properly calibrated prior to its use. It is anticipated that a large portion of the energy savings will result from correctly balancing the air systems and incorporating current air quantity and temperature/humidity criteria. Data collected during the audit shall, as a minimum, include:

3.1.3.1 Building data.

a. Building number, building age, number of floors, and gross square feet.

b. Floor area, HVAC zones, nonconditioned spaces, usage of space.

c. Glass areas.

d. Wall and roof surface areas and condition, type of construction, "U" factors.

e. Drawings, equipment schedules, distribution layouts, control diagrams, electrical drawings, lighting layout, fixture types, and lighting levels of major systems and areas.

f. Opportunities for maintenance improvements.

g. Nameplate data of major energy related equipment and the condition of the equipment.

h. An assessment of air flow rates, outside air, exhaust rates, water, and other energy media quantities, by zone or area as appropriate.

3.1.3.2 Weather information.

3.1.3.3 Operating methods.

a. Facilities operating hours.

b. System and equipment operating and control schedules.

c. Control set points, chilled water temperatures, and freeze protection temperatures.

d. Rooms, areas, or zones with special or critical requirements.

e. Building occupancy and distribution of personnel.

f. Frequency of use of building access points.

g. Unauthorized modifications to existing equipment/systems by building occupants.

3.1.3.4 Past performance records.

a. Energy peak demands.

b. Energy consumption (Gross BTU/yr and BTU/conditioned SF/yr).

c. Utility rate schedules.

3.1.3.5 Energy sources.

3.1.3.6 Boiler efficiency and water chemistry tests.

3.2 <u>Analysis</u>. The energy analysis is a comprehensive study of the facilities energy usage. It includes a detailed investigation of the facilities operation, its environment and its equipment. The analysis shall use computer modeling. Computer modeling shall be used to incorporate field survey data, weather

data, occupancy schedules, building construction data, energy distribution systems and equipment data into a model of the total facility. The computer program shall be used to develop load profiles, calculate energy savings, and evaluate energy conservation opportunities. The computer program shall be capable of analyzing the energy requirements of buildings, performance of heating, cooling, and ventilating equipment, energy distribution systems, and energy conversion equipment. The computer results shall be verified by comparing them to any available past utility bills or records. The computer program shall analyze the facility on an hour by hour basis rather than the bin data method or bin data to simulate an hour by hour analysis. Unless the Building Loads Analysis and Systems Thermodynamic (BLAST) program is used, the AE shall submit a sample computer run with an explanation of all input and output data and a summary of program methodology and energy evaluation capabilities for approval by the Contracting Officer prior to use of the program for analysis. The computer program used must be comparable to the BLAST program.

3.2.1 The energy analysis shall provide the following types of information:

a. A theoretical baseline of energy usage of the existing facility.

b. Peak heating and cooling loads.

c. Comparison of equipment capacities with expected requirements.

d. Energy usage by systems (lighting, heating, cooling, etc.).

e. Basis for evaluating ECOs.

f. A theoretical baseline of energy usage of the facility after incorporation of all recommended ECOs.

3.2.2 The AE shall develop graphic presentations, i.e., graphs and charts which depict a complete energy consumption picture for the hospital facilities both presently and after implementation of energy saving recommendations and include these in the report.

3.2.3 The AE shall develop a listing of each zone or area of the hospital as appropriate. The list shall include the air handling system serving the area, the existing supply, return and exhaust air quantities, temperature and humidity setpoints, lighting levels, types and number of light fixtures, differential pressure readings and similar data required for the analysis. The current criteria requirements for supply, return and exhaust

air quantities, temperature and humidity setpoints, lighting levels, etc., shall also be shown. The listing shall be in sufficient detail so that areas with potential energy savings from air balancing, incorporation of current criteria, control revisions and similar measures can be identified. The AE shall be familiar with the latest Army hospital criteria and shall evaluate installed systems for possible energy saving opportunities which may be permitted by current criteria.

3.2.4 If data is available, the AE shall develop an historical load profile by month for the past three fiscal years for each energy source used.

3.2.5 The AE shall project energy costs for three fiscal years from date of contract award. Department of Energy (DOE) projections are acceptable.

3.3 Identify ECOs. All methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures and maintenance practices as well as the physical facilities. A list of energy conservation opportunities is included as Annex A to this scope. This list is not intended to be restrictive but only to assure that at least these opportunities are considered, discussed and documented in the report. Those items on the list which are not practical, have been previously accomplished, are inappropriate or can be eliminated from detailed analysis based on preliminary analysis shall be listed in the report along with the reason for elimination from further analysis. All potential ECOs which are not eliminated by preliminary considerations shall be thoroughly documented and evaluated as to technical and economic feasibility. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions shall be clearly stated. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.

3.4 Energy Monitoring and Control Systems (EMCS)

3.4.1 The AE shall determine the feasibility of an EMCS for the hospital facility. Boiler and/or chilled water plants, laundries, kitchens, incinerators, and other similar facilities associated with the hospital shall be included, if appropriate. The intent of this study is to determine the basic conceptual architecture of the EMCS to the extent that primary economic calculations can be made to determine feasibility per ECIP criteria. The documentation shall be of sufficient accuracy to insure that

future project design calculations that will be done after completion of this study will not deviate more than 20 percent from the results of this study.

3.4.2 The AE shall survey all buildings and perform feasibility evaluations in accordance with guidance in HNDSP-84-076-ED-ME. Any existing EMCS project or any currently under design or study shall be considered and evaluated for integration. The AE shall consider connection of the hospital to this basewide system. The hospital would have control of the hospital functions with only monitoring capability at the basewide terminal. The evaluation shall recognize that hospital users may be reluctant to surrender control of their systems to installation operating engineers. An independent system for the hospital with the hospital having control and some type of communication with the basewide system for monitoring and data gathering shall also be considered. The use of existing survey data is acceptable only if it is in sufficient detail and can be easily revalidated by building walk through inspections. The standard evaluation forms contained in HNDSP-84-076-ED-ME shall be a part of the submittal. EMCS analyses and evaluations shall be developed using TM 5-815-2. EMCS cost shall be developed using the Cost Estimating Guides -- HNDSP88-207-ED-ME, HNDSP88-208-ED-ME, HNDSP88-209-ED-ME or HNDSP88-210-ED-ME -- depending on system size. Energy savings calculations shall be in accordance with NCEL CR 82.030. EMCS evaluations shall consider but not be limited to the following features:

a. Start/Stop Programs

Scheduling.
Duty cycling.
Load shedding for electrical demand limiting.
Lighting control.
Start/Stop Optimization.

b. Ventilation and Recirculation Programs

Dry bulb economizer.
Outside air reduction.

c. Temperature Reset Programs

Space Temperature night setback.
Hot and cold deck.
Reheat coil.
Chilled water.
Chiller selection.
Boiler selection.

d. Labor Savings/Monitoring. Example: Boiler plant

monitoring (EMCS logging of points which at present are manually logged).

3.4.3 The AE's recommendations for an EMCS shall be in sufficient detail to define the system configuration, the approximate quantity and types of control instruments and sensors, and the data transmission system. The selection of points to be monitored and controlled shall be given priority based upon ECIP criteria. The control system functions, expected energy reduction, and monetary savings (including the manner in which these savings are to be achieved) shall be explained.

3.4.4 At those installations where certain buildings cannot be economically connected to an EMCS, alternate means of control shall be evaluated. One method is single building EMCS and another is FM radio control.

3.4.5 The AE shall prepare and provide recommendations in narrative form. Input/output (I/O) summary tables shall be prepared and provided for each system selected in accordance with the HNDSP-84-076-ED-ME. Cost estimates shall be prepared and provided in accordance with the Cost Estimating Guides for the mechanical and electrical modifications required to implement the EMCS.

3.4.6 Inoperative controls shall be surveyed in accordance with TM 5-815-2. Cost estimates to repair and replace inoperative controls shall be as described in the Cost Estimating Guides.

3.4.7 Labor savings/monitoring shall be included, provided the SIR is not affected to the extent of jeopardizing the ECIP requirements.

3.5 Documentation. All energy conservation opportunities the AE has considered shall be included in one of the following categories and presented as such in the report:

3.5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $200,000, a Savings to Investment Ratio greater than one and a simple payback period of less than eight years. The overall project, and each discrete part of the project, shall have a SIR greater than one. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis summary sheet(s) (with necessary backup data to verify the numbers presented), and a project development brochure (PDB). These forms shall be separate from the report. They shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly. A life cycle cost analysis summary sheet

shall be developed for each ECO and for the overall project when more than one ECO is combined. For projects and ECOs updated or developed from the previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages updating and revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment of work the project or ECO was developed under in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. This information shall be included as part of the backup data. The purpose of this information is to provide a means to prevent duplication of projects in any future reports. For projects or ECOs the installation wants submitted as ECIP projects complete programming documentation shall be prepared.

3.5.1.1 Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex B. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study. Documents shall be complete as required for submission to higher DA headquarters. These programming documents will require review and signatures by the proper installation and hospital officials. All documents shall be complete except for the required signatures.

3.5.1.2 Project Development Brochures (PDBs). Preparation of PDBs requires the AE to delineate the functional requirements of the project as related to the specific site. The AE shall prepare PDBs in accordance with AR 415-20 and TM 5-800-3. Most projects will not require all the forms and checklists included in the Technical Manual (TM). Only that information needed for the project shall be included. The PDB-I format described in the TM shall be used for whatever information is needed.

3.5.2 Non-ECIP Projects. Projects which normally do not meet ECIP criteria, but which have an overall SIR greater than one shall be individually packaged and fully documented and included as a separate section in the volume containing the programming documentation. The life cycle cost analysis summary sheet shall be completed through and including line 6 for all projects or ECOs. Each shall be analyzed to determine if they are feasible even if they do not meet ECIP criteria. These ECOs or projects may not meet the nonenergy qualification test. For projects or ECOs which meet this criteria, the life cycle cost analysis summary sheet, completely filled out, with all the necessary backup data to verify the numbers presented, a complete description of the project and the simple payback period shall be included in the report. Additionally, these projects shall have

the necessary documentation prepared, in accordance with the requirements of the Government's representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost not over $100,000 and a simple payback period of two years or less.

b. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost of more than $100,000 and a simple payback period of four years or less.

c. Productivity Enhancing Capital Investment Program (PECIP). This program is for projects which have a total cost of more than $100,000 and a simple payback period of four years or less.

The above programs are all described and documentation shall be prepared in accordance with AR 5-4, Change No. 1. A sample implementation document, consisting of a DA Form 5108-R, sketches and manufacturers data and a life cycle cost analysis summary sheet shall be submitted for review and approval with the interim submittal. This sample shall be submitted and approved prior to the preparation of any other implementation documentation. To the degree possible, the project selected for the sample submission shall be typical of the majority of subsequent projects to be submitted. The sample shall consist of a complete implementation documentation with primary emphasis on format and manner of presentation rather than precise accuracy of cost estimates and energy saving data.

d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $200,000 and a simple payback period of eight to twenty-five years. Projects or ECOs which qualify for this program shall be economically analyzed in accordance with the requirements for Special Directed Studies in Engineering Technical Letter (ETL) 1110-3-332. Documentation shall be in accordance with paragraph 3.5.1 except that the economic analysis required by ETL 1110-3-332 shall be included in lieu of the ECIP life cycle cost analysis.

e. Low Cost/No Cost Projects. These are projects which the Director of Engineering and Housing can perform with his resources. For these projects the following information shall be provided:

(1) Brief description of the project.

(2) Brief description of the reasons for the modification.

(3) Specific instructions for performing the modification.

(4) Estimated dollar and energy savings per year.

(5) Estimated manhours and labor and materials costs. Costs shall be calculated for the current calendar year and so marked. Manhours shall be listed by trade. For projects that would repair an existing system so that it will function properly, also include the estimated manhours by trade and labor and material costs necessary to maintain the system in that condition. Some of the simple practical modifications may be developed on a per unit basis. An example of this type of modification would be the repair or replacement of steam traps on an as needed basis. As a rule, however, the AE should develop complete projects, if at all possible, rather than per unit modifications.

Separate sheets for each project showing the above information shall be prepared and included in the report.

3.5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

4. DETAILED SCOPE OF WORK: The general Scope of Work is intended to apply to contract efforts for all Army hospitals except as modified by the detailed Scope of Work for each specific installation. The detailed Scope of Work is contained in Annex D.

5. PROJECT MANAGEMENT

5.1 Project managers. The AE shall designate a project manager to serve as a point of contact and liaison for all work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager must be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for complete coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

5.2 Installation assistance. The Commanding Officer at each installation and the hospital Commander will each designate an individual who will serve as the point of contact for obtaining available information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

5.3 Public disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed under this contract, except as authorized by the Contracting Officer.

5.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE and/or the designated representative(s) shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

5.5 Site visits, inspections, and investigations. The AE, consultants, if applicable, and/or designated representative(s) thereof shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

5.6 Records

5.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representatives(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days a reproducible copy of the records.

5.6.2 The AE shall provide a record of request for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

6. SUBMITTALS, PRESENTATIONS AND REVIEWS

6.1 General. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other Government personnel. The AE shall prepare slides or view graphs

showing the results of the study to date for his presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The AE shall provide the comments from all reviewers and written notification of the action taken on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one working day. The presentation and review conferences will be at the installation on the date(s) agreeable to hospital personnel the Director of Engineering and Housing, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

6.2 Interim Submittal. An interim report shall be submitted for review after completion of the field survey and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings and SIRs of all the ECOs shall be included. The simple payback period of all ECOs shall be calculated and shown in the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government's representative shall coordinate with the hospital personnel and the Director of Engineering and Housing and provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. A sample implementation document (DA Form 5108-R, sketches and manufacturers data, life cycle cost analysis summary sheet and supporting data) for one project shall be submitted with this submittal for review and approval. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

6.3 Prefinal Submittal. The AE shall prepare and submit the prefinal report when all work under this contract is complete. The AE shall submit the Scope of Work for the installation studied and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary

of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The report shall include an order of priority by SIR in which the recommended ECOs should be accomplished. The synergistic effects of all of the ECOs on one another shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for all recommended projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal report, separately bound Executive Summary and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex C for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and ECOs developed during this study shall be included in the Executive Summary and shall include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

6.4 <u>Final Submittal</u>. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report, or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of complete volumes. If new volumes are submitted, they shall be in standard three-ring binders and shall contain all the information presented in the prefinal report with any necessary changes made. Detailed instructions of what to do with the replacement pages should be securely attached to the replacement pages.

7. <u>OPERATION AND MAINTENANCE INSTRUCTION</u>. The AE shall prepare a one-day instructional course for the mechanical and electrical operation and maintenance personnel to explain possible energy saving potentials due to modified equipment and systems operation. The course will identify operational items noted during the audit, which will effect energy conservation, and will explain the savings possible. This course will be held near the end of the study period at a time agreeable to the AE and the Government's representative. This course is in addition to the formal review and presentations required for the submittals. An outline of the topics that will be covered shall be submitted with the prefinal submittal.

8. <u>ENTRY AND EXIT INTERVIEWS</u>. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing and Hospital Commander before starting work at the hospital and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.

8.1 The entry interview shall thoroughly describe the intended procedures for the survey. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the Director of Engineering and Housing and hospital personnel.

e. Limitations imposed by hospital operations.

8.2 The exit interview shall include a thorough briefing describing the work accomplished, problems encountered, probable areas of energy conservation, and any follow-on efforts which may be required. The interview shall also solicit input and advice from the Director of Engineering and Housing and Hospital Commander.

9. <u>SERVICES AND MATERIALS</u>. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract shall be included in the lump sum price of the contraot.

ANNEX A

ENERGY CONSERVATION OPPORTUNITIES

Heating, ventilating, and air conditioning

1. Shut off air handling units whenever possible.
2. Reduce outside air intake when air must be heated or cooled before use.
3. Reduce volume of air circulated through air handling units.
4. Shut off unneeded circulating pumps.
5. Reduce humidification to minimum requirements.
6. Reduce condenser water temperature.
7. Cycle fans and pumps.
8. Reduce pumping flow.
9. Reset thermostats higher during cooling and lower during heating.
10. Repair and maintain steam lines and steam traps.
11. Use damper controls to shut off air to unoccupied areas.
12. Reset hot and cold deck temperatures based on areas with greatest need.
13. Raise chilled water temperature. (EMCS)
14. Shed loads during peak electrical use periods.
15. Use outside air for free cooling whenever possible. (Dry bulb economizers)
16. Reduce reheating of cooled air.
17. Recover heating or cooling with energy recovery units.
18. Reduce chilled water circulated during light cooling loads.
19. Replace hand valves with automatic controls.
20. Install variable air volume controls.
21. Insulate ducts and piping.
22. Eliminate simultaneous heating and cooling.
23. Install night setback controls.
24. Clean coils.
25. Maintain filters.
26. Repair and/or maintain air handling controls.
27. Multispeed/variable speed cooling tower fans.
28. Use centrifugal chillers instead of steam chillers.
29. Common manifolding of chillers.

Boiler plant

1. Reduce steam distribution pressure.
2. Increase boiler efficiency.
3. Insulate boiler and boiler piping.
4. Install economizer.
5. Install air preheater.
6. Blowdown controls.
7. Boiler and chiller control modifications.
8. Water treatment to prevent tube fouling.
9. Blowdown heat recovery.
10. Oxygen trim controls.

Lighting

1. Shut off lights when not needed.
2. Reduce lighting levels for 1975 addition.
3. Convert to energy efficient systems.
4. Reflectors for fluorescent fixtures.
5. Separate switches to control lighting arrangements.

Building envelope

1. Reduce infiltration by caulking and weatherstripping.
2. Install insulated glass or double glazed windows.
3. Install roof insulation.
4. Install loading dock seals.
5. Install vestibules on entrances.
6. Reduce window heat gain by solar shading, screening, curtains,or blinds.
7. Low emissivity windows.

Electrical equipment

1. Shut off elevators whenever possible.
2. Install capacitors or synchronous motors to increase power factor.
3. Use emergency generator to reduce peak demand.
4. Shed or cycle electrical loads to reduce peak demand.
5. Convert to energy efficient motors.
6. Variable volume pumping.

Plumbing

1. Reduce domestic hot water temperature. (split kitchen off from rest of the system)
2. Repair and maintain hot water and steam piping insulation.
3. Install flow restrictors.
4. Install faucets which automatically shut off water flow.
5. Decentralize hot water heating.
6. Add pipe insulation.

Kitchen

1. Shut off range hood exhaust whenever possible.
2. Install high-efficiency steam control valves.
3. Shut off equipment and appliances whenever possible.
4. Install makeup air supply for exhaust.
5. Install heat reclamation system for exhaust heat.
6. Turn off lights in coolers.
7. Water heating heat pump.
8. Install energy efficient exhaust hoods.

Miscellaneous

1. Install incinerator and heat recovery system.
2. Install computerized energy monitoring and control system.
3. Convert steam driven turbine to electric motor or gas.
4. Occupancy sensors to control lighting or HVAC.

EXHIBIT NO. 3

ANNEX B

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block, clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, assumptions and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures fixtures is not considered an ECIP type project.

g. An ECIP life cycle cost analysis summary sheet as shown

in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple payback period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost were calculated shall be clearly shown on the DD Form 1391.

j. The five digit category code number for all ECIP projects developed under this scope of work is 80000.

D. Exhibit No. 4 - Annex "C" is an informational outline for development of the executive summary.

E. Exhibit No. 5 - Annex "D" is the project detailed scope of work as developed by Fort Riley DEH and which modifies the requirements of Annex "A" general scope of work.

EXHIBIT NO. 4

ANNEX C

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data.

3. Present Energy Consumption.

   - o Total Annual Energy Used.

   - o Source Energy Consumption.

     Electricity - KWH, Dollars, BTU
     Fuel Oil - GALS, Dollars, BTU
     Natural Gas - THERMS, Dollars, BTU
     Propane - GALS, Dollars, BTU
     Other - QTY, Dollars, BTU

   - o Energy Consumption by Systems.

4. Historical Energy Consumption.

5. Energy Conservation Analysis.

   - o ECOs Investigated.

   - o ECOs Recommended.

   - o ECOs Rejected. (Provide economics or reasons)

   - o ECIP Projects Developed. (Provide list)*

   - o Non-ECIP Projects Developed. (Provide list)*

   - o Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

6. Energy and Cost Savings.

   - o Total Potential Energy and Cost Savings.

   - o Percentage of Energy Conserved.

- o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

7. Energy Plan.

   - o Project Breakouts with Total Cost and SIR.
   - o Schedule of Energy Conservation Project Implementation.

EXHIBIT NO. 5

ANNEX D

ENERGY SURVEY FOR THE
IRWIN ARMY COMMUNITY HOSPITAL
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
FORT RILEY, KANSAS

DETAILED SCOPE OF WORK

1. Brief Description of Work. This project involves a coordinated energy study, including a detailed energy survey for the Irwin Army Community Hospital complex at Fort Riley, Kansas. For the purpose of this work, the hospital complex will be considered the hospital proper, the boiler plan and the three associated barracks buildings. This study shall integrate the results of all prior and ongoing energy conservation projects, designs or plans with work done under this contract.

2. Authorization. This project is authorized by CEMP-ET letter dated 23 Nov. 89, subject: Energy Engineering Analysis Program (EEAP) - FY Program Guidance.

3. Services to be performed by the Contractor. The AE shall perform and shall assume responsibility for the accuracy of the work and completeness of the following services in connection with the above project in accordance with the General Scope of Work as amended by criteria and instruction listed herein. Quality of work accomplished under this contract will be a determining factor in consideration of the AE for future work.

a. Work under the basic contract shall consist of the efforts specified paragraphs in i.1 through i.4 and i.6 through i.23 and paragraph j of this Annex D.

b. Option 1 shall consist of the work specified in paragraph i.5 of Annex D and items listed under Heating, Ventilating and Air Conditioning of Annex A pertaining to the 1975 addition.

c. Option 2 shall consist of the work specified for the Boiler Plant as set forth by Annex A not contained in the base contract.

d. Option 3 shall consist of all remaining work in Annex A not required by the Base, Option 1 or Option 2.

e. POC at Fort Riley will be Mr. Larry Stillwagon at 913-239-2371.

f. POC at Kansas City District will be Mr. Robert McCormick at 816-426-2782.

g. ECIP projects shall be estimated to and programmed for implementation as FY 95 projects.

h. Ten 1391/PDB packages will be prepared. If a greater or smaller number of packages is required, a suitable adjustment to the contract price will be made.

i. In addition to the items specified in Annex A, the AE shall perform the following items:

1. Perform a total energy analysis of the hospital complex. Establish how, where and what type of energy is being used and what alternatives there are (i.e.,steam use - sterilization, kitchen heating, hot water).

2. Determine feasibility of Fort Riley purchasing the electrical substation feeding the hospital complex and supplying from the ANZIO substation. Capacity charges, energy charges and reliability should be considered.

3. Determine if the steam distribution system to the three barracks buildings should continue to be supplied by the hospital boiler or should they have their own boiler. Analyze whether it be more efficient for the barrack building to have small modular high efficiency units?

4. Evaluate the boiler steam pressure adjustment. Establish the maximum pressure needed and evaluate if the maximum varies during the year.

5. Evaluate HVAC system in the 1975 addition. Any new system or modification to the existing system should include reheat, reset or shutoff when unoccupied and/or reset of cooling.

6. Evaluate the EMCS system as it applies to the hospital complex to determine what modifications should be made.

7. Evaluate installation of new windows in dining area, chapel and bakery.

8. Evaluate steam trap monitoring system. Consider a computerized steam trap sensing system by Spirax Sarco or equal that measures conductivity downstream of traps.

9. Evaluate condensate return system for leaks and insulation.

10. Evaluate replacing steam system with low temperature hot water.

11. Evaluate heat recovery for outside air using heat pump or run around coils.

12. Evaluate replacing the existing chiller controls.

13. Evaluate water preheaters from chillers or heat pumps to reduce load on cooling tower/desuperheating.

14. Evaluate using smaller chiller for use during winter months.

15. Evaluate alternate chiller configuration (such as, gas fired and/or absorption and/or ice storage) for reduction of utility bills through reduction of electrical demand costs.

16. Evaluate installation of new smaller boiler for off peak loads.

17. Evaluate replacement or modification of boiler controls to increase excess air/peak efficiency.

18. Evaluate replacement of induced draft fans.

19. Evaluate heat recovery on blowdown comparing continuous vs periodic (flash and/or heat exchanger).

20. Evaluate boiler economizer to preheat feedwater or domestic hot water.

21. Evaluate reduction of boiler scale and deposits.

22. Evaluate the four preliminary ECOs developed by TVA.

23. Evaluate lighting in 1975 addition.

j. The AE shall develop a long range plan to identify all projects needed to make the hospital complex an energy saving institution. Projects shall be grouped in accordance with existing funding guidance.

4. Distribution. Fifteen (15) sets of each submittal shall be furnished to reviewers in accordance with the following distribution schedule:

Commander
U.S. Army Engineer District, Kansas City — 5 copies
ATTN: CEMRKED-MF/McCormick
700 Federal Building
Kansas City, MO 64106-2896

Commander — 2 copies
Missouri River Division
ATTN: CEMRDED-MA/Whelchel
PO Box 103, Downtown Station
Omaha, Nebraska 68101-0103

Commander — 5 copies
1st Infantry Division & Fort Riley
ATTN: AFZN-DE-E/Stillwagon
Building 408
Ft. Riley, KS 66442

Commander
USACE-CEEC-EE/Mr. D. Beranek
20 Massachusetts Avenue, NW
Washington, DC 20314

1 copy

Commander
HQ, FORSCOM
ATTN: FCEN-CDI
Fort McPherson, GA 30330-6000

1 copy

Transmission of documents will be by express mail or other expedient means. Only two (2) copies of the survey forms will be provided, one to CEMRK-ED-MF and one to Fort Riley.

5. <u>Data, Information and Services to be Furnished by the Government.</u> The Government will furnish the following data, information, and services:

a. AE Instructions, dated 13 March 1987.

b. Energy Conservation Investment Program (ECIP) Guidance, dated 25 April 1988 and revision dated 15 June 1989.

c. ETLs 1110-3-282, Energy Conservation; 1110-3-316, Hold Open Devices for Critical Care Areas of US Army Medical Facilities; 1110-3-318, Procedures for Programming Energy Monitoring and Control Systems (EMCS) Funded through the MCA Program; 1110-3-326, General Criteria for Army Medical Facilities; 1110-3-332, Economic Studies; 1110-3-344, Interior Mechanical Design Conditions for Army and Air Force Medical Facilities; 1110-3-354, Direct Digital Control of Heating, Ventilation and Air Conditioning (HVAC) System; 1110-3-355, Design Criteria for Medical and Dental Facilities; 1110-3-359, Steam for Humidification in Medical Facilities and 1110-3-370, Gross Floor Area Calculation for Medical Facilities.

d. TM 5-785, Engineering Weather Data, TM 5-800-2, General Criteria Preparation of Cost Estimates, TM 5-800-3, Project Development Brochure, TM 5-815-2, Energy Monitoring and Control Systems (EMCS) and TM 5-838-2, Army Health Facility Design.

e. AR 415-15, Military Construction Army (MCA) Program Development; AR 415-17, Cost Estimating for Military Programming; AR 415-20, Construction Project Development and Design Approval; AR 415-28, Department of the Army Facility Classes and Construction Categories; AR 415-35, Construction, Minor Construction; AR 420-10, General Provisions, Organization, Functions and Personnel; AR11-27, Army Energy Program; and AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.

f. HNDS-84-076-ED-E, Preliminary Survey and Feasibility Study for Energy Monitoring and Control System.

g. HNDSP88-207-ED-E, HNDSP88-208-ED-ME, HNDSP88-209-ED-ME and HNDSP88-210-ED-ME, EMCS Cost Estimating Guides.

h. NCEL CR 82.030, Standardized EMCS Energy Saving Calculations.

i. An example of a currently completed programming document for an ECIP project.

j. STUDY AND ANALYSIS - HEATING, VENTILATING AND AIR CONDITIONING SYSTEM - 1975 ADDITION BUILDING for the Irwin Army Community Hospital prepared by Massaglia, Neustrom, Bredson, Inc. date October 1987.

6. Completion Schedule. The AE shall complete the work and services for each increment as follows:

a. Interim submittal - within one hundred and eighty (180) calendar days of Notice to Proceed.

b. Prefinal Submittal - within sixty (60) calendar days of the interim submittal presentation and review conference.

c. Final submittal - within sixty (60) calendar days after prefinal submittal presentation and review conference.

The AE shall allow a period of approximately forty five (45) days for review by Government forces for each submission. Presentation of each submission will occur upon completion of the review period for that submission.

7. Method of Payment.

a. Title I Services - Design. Payment for design work and services will be made in accordance with the following procedures:

Partial Payment. The Architect-Engineer shall prepare and submit to the U.S. Army Engineer District, Kansas City, partial payment estimates using ENG Form 93, which shall serve as the request for payment. All partial payments shall be based on work completed as of the 15th day of the report month and shall be submitted to the office of the Contracting Officer by the 18th day of the month. The pay estimate shall be submitted with ENG Form 93, in accordance with the "Instructions for Completion of ENG Form 93 - Payment Estimate, "dated 5 January 1983. The U.S. Army Engineer District, Kansas City, will prepare supporting payment documents after obtaining necessary approvals and forward all documents to the U.S. Army Engineer District, Omaha, for issuance of the payment check. All questions, regarding payments shall be directed to the U.S. Army Engineer District, Kansas City.

b. Additional Conferences. Payment for furnishing the services of technically qualified representatives to attend conferences other than the review conferences specified above, when so requested in writing by the Contracting Officer, will be made at the rate per hour for the discipline involved plus travel expenses computed in accordance with Government Joint Travel Regulations. Payment for attending additional conferences shall be made after submittal of a separate ENG Form 93, which shall not be assigned a partial payment estimate number.

Video Record. The government reserves the right to make a video record of the presentation.

9. Clarification. The following clarification shall be made to the General Scope of Work:

a. The analysis of the 1955 original building shall consist of only the items in Annex D. Items specified under Annex A are not required.

b. The HVAC audit for the 1975 addition will be handled on a major system basis with test and complete analysis accomplished on major items. Local areas will be addressed on a typical basis using only spot check testing. Small scale drawing will be used and items not done to full ECO documentation will be accomplished by narrative summary. Record drawings shall be used when possible.

c. TRACE will be used instead of BLAST for computerized analysis. Manual calculations may be used when complexity of ECO does not warrant computer analysis.

d. Delete operation and maintenance analysis requirements specified in the General Scope of Work.

e. Delete solar energy considerations requirements specified in the General Scope of Work.

f. Delete requirements of paragraph 3.4.(EMCS) in the General Scope of work. EMCS requirements in Annex D shall be required.

g. The selection of ECOs for detailed analysis shall be coordinated between the AE and Government prior to start of analysis.

h. Data will be collected using both field data (investigation, testing and interviewing) and as-built drawings. It is assumed that most of the static information will be obtained from as-built drawings (i.e. pipe sizes, length, existing physical conditions). Dynamic information shall be obtained from field testing (i.e. actual air flow rates, pressures, temperatures).

i. Only building data needed to accomplish specific items need be obtained.

j. Only small scale drawings and simplified flow diagrams shall be required. Detailed drawings such as distribution layouts, control diagrams and lighting and fixture layout will not be required. Only information sufficient to properly justify and support the ECOs are required.

1.4 BASIC CRITERIA:

A. Project criteria consists of the following Government furnished information and technical references:

1. ECIP Guidance dated 25 April 1988 and revision dated 28 June 1991.

2. Engineering Technical Letters:

1110-3-282, Energy Conservation

1110-3-316, Hold Open Devices for Critical Care Areas of U. S. Army Medical Facilities

1110-3-318, Procedures for Programming Energy Monitoring and Control Systems (EMCS) Funded through the MCA Program

1110-3-326, General Criteria Standards for Army Medical Facilities

1110-3-332, Economic Studies

1110-3-344, Interior Mechanical Design Conditions for Army and Air Force Medical Facilities

1110-3-354, Direct Digital Control of Heating, Ventilation, and Air Conditioning (HVAC) Systems

1110-3-355, Design Criteria for Medical and Dental Facilities

1110-3-359, Steam for Humidification in Medical Facilities

1110-3-370, Gross Floor Area Calculation for Medical Facilities

3. Technical Manual:

TM 5-785, Engineering Weather Data

TM 5-800-2, Cost Estimates - Military Construction

TM 5-800-3, Project Development Brochure

TM 5-815-2, Energy Monitoring and Control Systems (EMCS)

TM 5-838-2, Army Health Facility Design

4. Army Regulations:

AR 5-4 *C-1, Productivity Improvement Program

AR 11-27, Army Energy Program, 7 July 1985

AR 11-27, Army Energy Program Update, 13 August 1989

AR 415-15, Military Construction, Army (MCA) Program Development

AR 415-20, Project Development and Design Approval

AR 415-28, Department of the Army Facility Classes and Construction Categories (Category Codes)

AR 415-35, Minor Construction, Emergency Construction, and Replacement of Facilities Damaged or Destroyed

AR 420-10, Management of Installation Directories of Engineering and Housing

5. EMCS Cost Estimating Guidelines:

   HNDSP 88-207-ED-ME, Large EMCS

   HNDSP 88-208-ED-ME, Medium EMCS

   HNDSP 88-209-ED-ME, Small EMCS

   HNDSP 88-210-ED-ME, Micro EMCS

6. Preliminary Survey and Feasibility Study for Energy: Monitoring and Control Systems

   HNDSP 84-076-ED-ME

7. User Guide for Single Building Controllers:

   NCEL UG-0010

8. Architectural and Engineering Instruction Manual revised 24 December 1990.

9. Interim Submittal annotated review comments dated July 1, 1991.

10. Pre-final Submittal annotated review comments dated November 25, 1991.

1.5 SOURCES OF INFORMATION

A. The following construction record drawings were the basic documents used for survey and investigation of the existing five building hospital complex.

   1. Irwin Army Community Hospital Electrical/Mechanical Repair, Phase I and II dated June 1985.

2. Irwin Army Hospital Additions and Alterations dated June 1980.

3. Nurses Quarters, Building 610 dated May 1959.

4. Family Housing Barracks Building 620 and 621 dated October 1960.

B. Where construction record drawings were not available, the following contract documents were utilized:

1. Irwin Army Hospital Additions and Alterations dated April 1975.

2. Irwin Army Community Hospital Electrical/Mechanical Repair dated July 1986.

C. Original construction and subsequent changes were verified by survey teams in mechanical, electrical, and architectural disciplines. Surveys were generally limited to observations of work exposed to view and in concealed spaces observed through accessible ceilings and access panels. Construction not observed is assumed to be essentially as shown on construction drawings.

D. Air flow measurements at air handlers and exhaust fans located in the 1975 Addition third floor mechanical room penthouse were measured by the survey team using pitot tubes and magnehelic gauges. Measured air flows are tabulated in Volume III - Survey Data of this report. Due to the recently completed Mechanical/Electrical Repair of Irwin Army Community Hospital, air handling unit air flow information for the 1955 Hospital Building was taken from the following contract Test and Balance Reports.

1. Energy Masters Corporation, Test and Balance Report dated July 1987.

2. Precisionaire, Inc., Test and Balance Report dated December 1989.

E. Waterflow measurements were recorded at various air handlers, representative mechanical rooms and energy plant by the survey team using a Polysonics Flowmeter, Serial No. 7028. Measured waterflows are tabulated in Volume III - Survey Data of this report.

F. Lighting levels in representative rooms were measured by the survey team using a Gossen "Panlux" electronic luxmeter, Serial No. 9D69619. Measured footcandle levels are tabulated in Volume III - Survey Data of this report.

G. Many room uses have been changed from those shown on "record" drawings, affecting mechanical and electrical requirements. Room numbers, with functions as provided by the Government are used for this report.

H. Utility information was obtained from the Fort Riley, Director of Engineering and Housing.

I. General information relating to hospital functions, medical equipment, and physical condition and operation of mechanical and electrical systems was obtained from interviews with administrative and operating personnel of the hospital.

J. Government personnel familiar with existing hospital systems provided information regarding system condition.

K. Vendor specifications were used to provide cost and performance data on equipment being considered for use in reducing energy consumption.

L. The 1991 "Means Cost Estimating Guide" was used to provide cost data for project estimating.

1.6 RELATED DOCUMENTS:

A. Refer to Study and Analysis Heating, Ventilating and Air Conditioning System 1975 Addition Building dated October 1987 for background information regarding the hospital 1975 Addition HVAC System. This report was prepared by Massaglia.Neustrom.Bredson, Inc.

B. Energy Engineering Analysis Program Interim submittal dated April 1991 prepared by Massaglia.Neustrom.Bredson, Inc.

C. Energy Engineering Analysis Program Pre-final Submittal dated September 1991 prepared by Massaglia.Neustrom. Bredson, Inc.

1.7 INTERIM SUBMITTAL REVIEW CONFERENCE DATA:

A. An interim submittal review conference covering Energy Engineering Analysis Program, Irwin Army Community Hospital, Fort Riley, Kansas was accomplished July 16, 1991 at the office of DEH at Ft. Riley, Kansas.

B. Annotated review comments are included in this section. A summary of action notations shown on the annotated review comments is as follows:

"A" indicates that the comment was accepted as valid and will be complied with.

"B" indicates that there was disagreement regarding the comment and an explanation has been included as part of this memorandum.

"C" indicates that final resolution of the comment could not be accomplished during the conference and future action will be taken to check and resolve status of the comment.

"D" indicates that the comment was deleted with reason. Reason for deletion is included as part of this memorandum.

C. This paragraph covers review comments. A separate subparagraph is provided for each set of review comments.

1. This subparagraph covers comments dated 30 May 1991 by Larry Stillwagon. Following, in the same order as listed on the attached comments, is the current status of each item.

   a. Action notation for this item is "A". A/E provided copies of technical articles on maintaining domestic hot water at 140 degrees F. to prevent the growth of Legionella Bacteria. Mr. Stillwagon will check for Government regulations that comply private industry.

   b. Action notation for this item is "A". A/E will use 10 years in accordance with 10 USC 2865. Bob Miller will try to find a copy of 10 USC 2865 for A/E use.

   c. Action notation for this item is "A". Next submittal will include complete ECO titles with description in the Table of Contents.

   d. Action notation for this item is "A". A/E agrees with comment. ECO for Hospital substation

purchase will be deleted from further consideration.

e. Action notation for this item is "A". A/E agrees with comment. Computer program utilizes boiler efficiency curve with maximum efficiency input as 78 percent. A/E will reevaluate and revise calculations to include combining this ECO with Off-peak Boiler ECO.

f. Action notation for this item is "A". A/E agrees that the piping loss is to be 10 percent. A/E will revise calculations accordingly.

g. Action notation for this item is "A". A/E agrees that the KWH value for T0015080 ALT 3 is 434,999.

h. Action notation for this item is "A". Calculations include efficiency of 90 percent for distribution piping system, 80 percent efficiency for heat exchanger and 78 percent efficiency for boilers.

i. Action notation for this item is "A". A/E agrees that Prefinal Submittal will identify acronym when first used and origin of acronym.

j. Action notation for this item is "A". Calculations include efficiency of 90 percent for distribution piping system, 80 percent efficiency for heat exchanger and 78 percent efficiency for boilers.

k. Action notation for this item is "A". A/E agrees with comment. Costs have not been developed for converting existing pneumatic controls to DDC. Further calculations will be coordinated with Larry Stillwagon.

l. Boiler efficiency is included in computer calculations. Comment withdrawn. A/E to verify cost.

m. Mr. Jack Blankin and facility personnel check traps three times weekly by visual check.

n. All agreed steam trap ECO is not cost effective. No further calculations will be required. ECO eliminated from project.

o. Action notation for this item is "A". A/E agrees and will combine with other select ECO's to determine cost effectiveness.

p. Action notation for this item is "A". A/E will reevaluate in conjunction with chiller replacement project.

q. Action notation for this item is "A". A/E will reevaluate in conjunction with previous comment.

r. Action notation for this item is "A". A/E will try to get cost as accurate as possible utilizing industry standard guidelines.

s. Action notation for this item is "A". A/E will reevaluate and consider preheater using cooling tower desuperheater in conjunction with boiler blowdown.

t. Action notation for this item is "A". A/E will reevaluate combining ECO with alternate chiller evaluation.

u. Action notation for this item is "A". A/E will reevalute different alternatives with possible input from "CERL". A/E to contact Gary Stankey at "CERL".

v. Action notation for this item is "A". A/E agrees to reevaluate ECO.

w. Action notation for this item is "A". A/E will reevaluate replacement of induced draft fans with replacement of boiler controls.

x. Action notation for this item is "A". A/E agrees to reevalute with consideration to use blow-down to heat domestic hot water. 209 degrees F. is based on equipment manufacturer data and overall effectiveness of the heat exchanger.

y. No action required. Blowdown is stated to be periodic and manually controlled.

z. Action notation for this item is "A". A/E agrees to reevaluate entry door ECO. Look at TVA study as guide.

aa. No action required. Further evaluation of this ECO not required. Consideration should be given to replacing three-way valve.

ab. A/E will continue further evaluation. Coordinate ECO scope with logistics.

ac. Action notation for this item is "A". A/E will reevaluate and coordinate with Larry Stillwagon.

ad. Gas increase due to computer round-off. Change insignificant. Delete ECO from further calculations.

ae. ECO was discussed. All agreed to delete ECO from further consideration due to poor payback.

af. Action notation for this item is "A". A/E will reevaluate ECO using 50 percent single glaze and 50 percent double glaze.

ag. Action notation for this item is "A". A/E will reevaluate ECO resetting domestic hot water temperatures using 1990 National Standard Plumbing Code and new A/E instructions from Bob Miller.

ah. Action notation for this item is "A". A/E will reevaluate and prepare SIR analysis. Fuel should be considered as operating cost. Additional monthly data from KPL will be analyzed. Attached calculations provided by Larry Stillwagon were discussed.

2. This subparagraph covers comments dated 6 June 1991 by Russ Goering. Following, in the same order as listed

on the attached comments, is the current status of each item.

a. Action notation for this item is "A". A/E will provide reevaluation with ECIP guidance life cycle cost analysis.

b. Action notation for this item is "A". See Larry Stillwagon's comments. Reevaluation will combine ECO's.

c. Action notation for this item is "A". A/E will provide reevaluation with ECIP guidance life cycle cost analysis.

d. Action notation for this item is "D". Comment was withdrawn. ECO was deleted by previous comment.

e. A/E will provide narrative explaining options considered for heat recovery.

f. Action notation for this item is "A". A/E will reevaluate. See Larry Stillwagon's comments nos. 16 and 17.

g. "NOTED". See Larry Stillwagon's comment no. 16.

h. "NOTED". See Larry Stillwagon's comment no. 19.

i. "NOTED". See Larry Stillwagon's comment no. 20.

j. Action notation for this item is "A". A/E agreed to expand ECO narrative to define assumptions used in calculations.

k. Detailed life cycle cost not required for these projects. A/E will develop ECIP guidance life cycle costs with further calculations.

l. Action notation for this item is "A". A/E agreed to reevaluate using smaller capacity off-peak boilers.

m. Life cycle cost not required. See comment above.

n. "NOTED". See Larry Stillwagon's comment no. 16.

o. "NOTED". See Larry Stillwagon's comment no. 29.

p. Life cycle cost not required. See comment above.

q. Yes, VAV considerations are defined in the narrative.

r. Life cycle cost not required. See comment above.

s. A/E will expand narrative to include assumptions used in calculations. Calculated savings is 18 percent of building energy usage.

t. "NOTED". See Larry Stillwagon's comment no. 34.

3. This subparagraph covers comments by Ira Scales. Following, in the same order as listed on the attached comments, is the current status of each item.

a. Action notation for this item is "A". A/E agrees computer calculated load is based on an average weather tape. Actual hospital cooling load exceeds 950 tons and is understood by the A/E.

b. "NOTED". See Larry Stillwagon's comment no. 21. A/E will reevaluate alternate chiller configuration.

c. "NOTED". A/E will reevaluate based on manual periodic blowdown.

d. All energy usage was included in calculations except chemical treatment cost/energy.

e. Volume three "Survey and Supporting Data" included documented site visit dates and names of personnel contact for project information. A/E will attempt to improve public relations with operating personnel.

4. This subparagraph covers comments dated 21 May 1991 by Dial. Following, in the same order as listed on the attached comments, is the current status of each item.

a. Action notation for this item is "A". The list of Energy Conservation Opportunities is Government furnished and is part of the contract. See page 23 of Volume II.

b. Action notation for this item is "A". The list of applicable documents defined on page 36 is part of the contract documents.

c. Action notation for this item is "A". Air handlers have steam heating coils. Narrative will be revised.

d. Action notation for this item is "A". ECO was not recommended for further evaluation.

e. Action notation for this item is "A". The narrative will be expanded to include chilled water source.

f. Action notation for this item is "A".

g. Action notation for this item is "A". The change is insignificant.

h. Action notation for this item is "A". Unit S-8 is identified on page 132 as TRACE 600 zone no. 506.

i. Action notation for this item is "A". Change is insignificant.

j. Action notation for this item is "A". Explanation of assumptions will be provided in future calculations.

k. "NOTED". See Larry Stillwagon's comments.

l. Action notation for this item is "A". Total project cost should be $9,176.00.

m. Action notation for this item is "A". Cost difference between 15 versus 16 shower heads is insignificant.

n. Action notation for this item is "A". A/E will revise design conditions to -10 degrees F. with explanation.

o. Action notation for this item is "A". Trace run referred to in comment is for basic building.

p. Action notation for this item is "A". Original pages 147 to 159 were omitted from some report copies which explain methodology.

5. This subparagraph covers comments dated 20 May 1991 by Quilty. Following, in the same order as listed on the attached comments, is the current status of each item.

   a. Action notation for this item is "A". Caulking is included in replacement cost of windows. All cost to be verified with further calculations.

6. This subparagraph covers comments dated 1 July 1991 by Grigsby. Following, in the same order as listed on the attached comments, is the current status of each item.

   a. Explanation is on page 15 of volume 1. Kitchen hood project is an operational change only.

b. Action notation for this item is "A". A/E will reevaluate. Additional information on reflectors was provided to conference reviewers.

ENERGY ENGINEERING ANALYSIS PROGRAM

INTERIM SUBMITTAL
REVIEW CONFERENCE

JULY 16, 1991

Bob Miller	KCD	816-426-7348
Jack Blanken	DEH	913-239-7537
Larry Stillwagon	DEH	913-239-2371
Richard Daugherty	MNB	816-931-2200
Maryhelen Maggard	MNB	816-931-2200
Randy Frymire	MNB	816-931-2200

ANNOTATED COMMENTS FROM REVIEW CONFERENCE DATED JULY 16, 1991.

TRANSMITTAL SLIP

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106-2896

REPLY TO: MRKED-MF   DATE 7-1-91

MAIL TO:
Mr. Randall D. Frymire, P.E.
Massaglia, Neustrom, Bredson, Inc.
211 W. Armour Blvd.
Kansas City, Mo. 64111

REMARKS:
EEAP, Irwin Army Hospital, Ft Riley, Ks.

Attached are the comments from Riley and from our mechanical, electrical and architectural sections.

I'll see you at Riley at 10:00 AM on July 16th.

RECEIVED
JUL 03 1991
MASSAGLIA - NEUSTROM - BREDSON, INC
CONSULTING ENGINEERS

Bob Miller
Project Manager

INCLOSURE(S)

INITIALS

MRK FORM 188 (COMPUTER EDITION)

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: CEMRK-ED-MF

Plans & Specifications / Design
_ Concept _ Final X Other: INTERIM SUBMITTAL

PROJECT: DACA41-90-C-0114
IACH EEAP

Designed by:
X A/E _ Dist _ DFE

SUSPENSE DATE:___________

Comments by: Larry Stillwagon

Division: DEH-EE

Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
Pg 14, Exec. Summary (ES)	1	Provide copy of reference material on growth of Legionella Bacteria (I found reference in ECO 35). AR 11-27, Army Energy Program, states that Hot Water temperatures for general domestic uses will not exceed 95^{O}F at the destination so this 135^{O}F reference is new to me. I will have to check on this.	#1 "A" A/E PROVIDED TECH. ARTICLE AT REVIEW CL LARRY STILLW WILL PROVIDE FURTHER DIREC
Pg 15, ES, B.1	2	Use 10 years. Newly published 10 USC 2865 states that the selection of energy conservation measures shall be limited to those with a positive net present value over a period of 10 years or less.	#2 "A" A/E WILL USE 10 YEARS. OR MILLER W T TO FIND COPY O 10 USC 2865 A/E USE.
General	3	Please put the title of the ECO in the INDEX of Volume 2: Calculations and Analysis. It is necessary to go to the table in the Executive Summary to get the ECO number before looking it up in Volume 2.	#3 "A" NEXT SU WILL INCLUDE ECO TITLES.
ECO 1a, P160	4	There is a problem with this analysis. During my review of the materials starting on page 160 I found several errors. The first error was the calculation of the Substation Ownership Discount @ $.20/KVA. All of the figures are too large. It appears that the $.20 was taken times the Capacity Charge ($) not the Capacity. The second type of error was simple math or transposition of numbers on some of the monthly calculations. I have attached summary and backup sheets showing what I believe the figures should be. Unless I've also made some errors, the savings for the purchase of the substation comes out to be $31,625.35 not $331,243.04 so this project cannot be justified on an economic bases.	#4 "A" A/E AGREES WITH COMMEN ECO WILL BE DELETED FR FURTHER CONS ERATION.
ECO 2a	5	A boiler efficiency of 78% is used for these calculations, which might be true for full load operation, but what about part load operation? Page 610 states that the average	#5 "A" AGREE WITH COMMENT M. PROGRAM UTILIZES BOIL EFFICIENCY C

FORT RILEY - FACILITIES ENGINEERS
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SUSPENSE DATE:___________

Comments by: Larry Stillwagon
Division: DEH-EE
Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
		boiler efficiency for fy 90 was 0.69. It would seem to me that the efficiency of the plant would go down a great deal during part load operation. At least 2 or 3 months out of the year the boilers would be at part load and it would be even more if the steam driven chillers were replaced. These ECO's could be combined with others to allow for a small non-heating season boiler.	A/E WILL RE EVALUATE ANI REVISE CALC TO INCLUDE COMBINED EC
ECO 2a	6	The calculations done on this ECO use a piping efficiency of 90% when looking at the domestic hot water while the assumption states that there is a 20% loss, which is it?	#6 "A" AGREE PIPINC LOSES TO BE 10%. REVISE CALCS. ACCORDI
ECO 2a	7	The KWH value for T0015080 ALT 3 in the appendix is 434,999 while the value used on page 188 is 434,699, Which is it?	#7 "A" AGREE 434,99 IS CORRECT.
ECO 2a, P 188	8	On the base run annual MCF where do the figures 0.8 and 1.1 come from. I see from ECO 5 that they are 90% for piping and 80% for Hx. Shouldn't the 78% boiler eff. be included and why do you use 1.1 instead of 1.25 (1/.8). #8	CALCULATIONS INCLUDE EFFIC OF 90% PIP 80% HEAT EXC AND 78% BO
General	9	Please identify what/where a number or acronym is or came from when you start using it.	#9 "A" AGREE - PREFIN SUBMITTAL WI IDENTIFY ACRO
ECO's 2b & 2c	10	These two ECO's have the same basic problems as ECO 2a. #10	"A" SEE COMM #8 ABOVE.
ECO 4, P 221	11	Have you developed what the costs would be for utilizing the EMCS for controlling the HVAC systems? Were you able to identify any energy savings for having the control systems changed to Direct Digital Control? There must be some energy savings by just having the controls stay in calibration. You say that the modification would not require	#11 "A" AGREE WITH COMMENT. COS HAVE NOT BE DEVELOPED I DDC. FURTH CALCS. WILL

FORT RILEY - FACILITIES ENGINEERS
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SUSPENSE DATE:__________

Comments by: Larry Stillwagon
Division: DEH-EE
Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
		hardware changes and that the cost to write the software programs would be offset by the annual costs to calibrate and recalibrate the pneumatic controls. This sounds like the payback would be one year or less and would qualify for one of the special funding programs or it could be added to the other EMCS work to help it qualify. ECIP projects can include up to 25% nonenergy savings. Please identify costs and savings for this work.	WILL BE COORDINATED WITH LARRY STILLWAGON.
ECO 5, P 235	12	# 12 The savings in MCF of Natural Gas includes 90% for piping and 80% for Hx. Why doesn't it use 80% for piping and include the boiler eff?	BOILER E[illegible] INCLUDED IN COMPUTER RU[illegible] COMMENT WITH DRAWN. A/E VARIFY COST.
ECO 6, P 246	13	The statement is made that from your visual survey all traps appeared to be in working #13 order. Were these traps checked in any way to determine if they were leaking through. I find it very hard to believe that all traps are in good working order. If all traps are in good working order it would be difficult to justify a project from this information.	MR. JACK BLANKIN CHEC[illegible] FOR TRAP B[illegible] BY 3 TIMES WEEKLY BY VISUAL CHECK STEAM VENTS
ECO 6, P 242	14	I assume from the cost figures that this ECO analysis is for an individual trap. Am I #14 right? If it is, are we talking about a 500 trap system with a projected cost of over $800,000. Does the existing EMCS have the capacity to accept an additional 500 points? A random sample of traps or some other type of acceptable engineering estimate would be needed to develop the energy savings estimate for the economic analysis for this project.	STEAM TRAP ECO IS NOT COST EFFECTI[illegible] NO FURTHER CALCULATIONS WILL BE REQUIRED
ECO 8	15	This suggested ECO was not a stand alone #15 project. The use of steam for operation of the chillers and the steam to the barracks and nurses quarters has to be included. This	"A" - AGREE A[illegible] WILL CO[illegible]N. WITH OTHER SELECT ECO[illegible]

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

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SUSPENSE DATE:___________

Comments by: Larry Stillwagon

Division: DEH-EE

Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
		is why I asked for a total energy analysis of the hospital complex. Some of the items listed in Annex D of the basic contract are very interrelated and cannot be justified by themselves but can be justified when done in conjunction with other items.	
ECO 10	16	The three-way valves in the 1975 addition have had their bypass line valves closed so they are operating as two-way valves. There should not be a problem with flow imbalance. A problem may exist because of the capacity of the production pumps, but that is why I asked for a chiller control analysis. Maybe something could be added to the distribution side of the system to prevent the imbalance.	#16 "A" A/E WILL R[illegible] EVALUATE.
ECO 10, P 277	17	The one additional production pump would not be required to run all 5935 HR/YR. It is only required to run when there is an imbalance and with the two-way and modified three-way valves that should only be part of the time.	#17 "A" A/E WILL R[illegible] EVALUATE IN CONJUNCTION WITH COMM[illegible] #16.
General	18	The economic analysis of these ECO's must include all costs and savings. If actual values are unavailable then "defendable" engineering estimates must be provided.	#18 "A" A/E WILL TR[illegible] TO GET COST ACCURATE AS POSSIBLE.
ECO 11	19	This ECO by itself may not be cost effective but with all of the waste heat that is created in the boiler plant it may be cost effective to install a domestic hot water preheater in the boiler plant and a separate 4" hot water supply line to the existing hot water tanks located in bldg 600. From ECO 36 bldg 600 uses 5000 gph of hot water raised from 40 to 140^{O}F for a heat requirement of 4,165,000 Btu/hr.	#19 "A" A/E WILL CON[illegible] PREHEATER US[illegible] COOLING TOWE[illegible] DESUPERHEAT[illegible] BOILER BLOW DOWN.

FORT RILEY - FACILITIES ENGINEERS
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Comments by: Larry Stillwagon

Division: DEH-EE

Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
ECO 12	20	The write up on page 288 says that energy will be saved during the winter when the cooling load is smaller by operating a chiller that more nearly matches the load but the computer printouts show that the savings are from Mar thru Dec not Jan and Feb. It would appear that a 150 Ton chiller would be beneficial year around. If your looking at a small chiller in the boiler plant this ECO should be combined with ECO 13 to help it pay back.	#20 "A" AGREE - A/E RE-EVALUATE COMBINING EC
ECO 13	21	These alternatives should have looked at the way that the chillers are operated and how they would be operated. The different cost for energy between electricity and gas, and the time of day and what the effect would be on our electrical demand charge should dictate when the different chillers are run. It would seem to me that with the cost of electricity over 3 times higher than natural gas per mmBTU and no peak demand charge for natural gas the choice for units to run first would be the gas combustions units not the electric chillers. The Analysis of chiller replacement study that I gave you from CERL indicated that four 150 Ton gas fired chillers was a viable option especially if the waste heat could be used. These options need to be reevaluated with the view for what would be the lowest cost energy source and least cost operation. Also item 19 comments on waste heat recovery should be included.	#21 "A" AGREE - A/E WILL RE-EVALUATE DIFF ALTERNATIVES POSSIBLE INPU FROM "CERL" A/E TO CONT. GARY STANKE @ "CERL".
ECO 14	22	How did you come up with a 20,000 MBH boiler for off-peak use? Page 343, paragraph 3 states that the base load is 7,445 lb/hr for Domestic Hot Water, Sterilizers, and Kitchen Equipment, and the tables on pages 611 and 612 show that 15% (63.5% of total hours) load for space heating is 3,282 lb/hr. It seems	#22 "A" AGREE - A/E TO RE-EVALUA ECO.

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

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Comments by: Larry Stillwagon

Division: DEH-EE

Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
		to me that a boiler that produces around 7,000 to 10,000 lb/hr of steam would make more sense as an off-peak boiler then one that will carry almost the entire load (70% of capacity or 23,000 MBH, page 344). This same boiler could carry the entire load during the summer if the steam driven chillers are changed out to gas driven.	
ECO 16	23	The reason this ECO was recommended by DEH personnel was because the fans were not replaced during the project to replace the boiler controls and statements were made that the boiler controls would/could not operate properly due to problems with the existing fans. It was felt that if the fans were properly sized and balanced with the forced draft fans then the boilers would operate more efficiently. I request that you reevaluate this ECO.	#23 "A" A/E WILL RE-EVALUATE REPLACEMEN OF ~~[illegible]~~ IN DRAFT FAN.
ECO 17	25	The current mode of operation at IACH boiler plant is periodic manual blowdown based upon boiler chemistry samples. This ECO was to evaluate manual vs continuous blowdown and heat recovery using a heat exchanger or flash tank. Several energy books state that there can be savings obtained by going to automatic blowdown controlled by monitors for pH and conductivity and even more savings by using heat recovery. I don't understand why the temperature of the boiler feed water can only be heated to 209°F instead of 225°F. If you use a flash tank followed by a counter flow heat exchanger you should be able to get a higher temperature. This ECO needs to be reevaluated.	#25 "A" A/E AGREE RE-EVALUATE WITH CONSIDE TO USE BLO DOWN TO H DOMESTIC H WATER. 209 IS BASED EQUIP MFG DATA.

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

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SUSPENSE DATE:__________

Comments by: Larry Stillwagon

Division: DEH-EE

Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
ECO 19, P 355	26	#26 The last sentence in the first paragraph states that there is a continuous surface blowdown. According to Operating Personnel this is not true.	BLOWDOWN I STATED TO BE PERIODIC MANUAL.
General	27	I can't find an evaluation of the doors on the south side of the hospital (out patient records and the emergency room). These doors had a problem of both sets of automatic doors open at the same time. The TVA study looked at installing a separate door system near the automatic doors for foot traffic and leaving the automatic doors for patients in wheel chairs or on crutches. I would think that a push button that would open the door on demand and manual operation the rest of the time would be one way to fix this problem, but maybe you have other ideas.	#27 "A" A/E AGREE TO RE-EVAL ENTRY DOOR ECO. L AT TVA STUDY AS GUIDE.
ECO 21	28	#28 The three-way valves are operating as two-way valves because the bypass lines are closed. If these three-way valves are such a problem, we should look at changing them over to two-way valves. I assume that from your comment on page 371 that with the 1975 flow varying because the three-way valves are operating as two-way valves there would also be very little savings so this ECO would be even less cost effective if you recalculated it.	FURTHER EVALUATION THIS ECO REQUIRED. CONSIDERATIO SHOULD BE GIVEN TO REPLACING 3-WAY VAL
ECO 22a & 22b	29	Both of these ECO's appear to be cost effective. Do you have any idea what size of a project we are talking about? If we do the conversion of the lights will the occupancy sensors still be cost effective? Have you looked at any other devices or lighting fixtures or is this just a preliminary evaluation? #29	A/E WILL CONTINUE FURTHER EV UATION. COOR DINATE WIT LOGISTI

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: CEMRK-ED-MF

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Designed by:
X A/E _ Dist _ DFE

SUSPENSE DATE:__________

Comments by: Larry Stillwagon

Division: DEH-EE

Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
ECO 23	30	I find it hard to believe that there is nothing that we can do to the 1975 addition HVAC system that would payback from energy savings. Have you included all costs and savings in your calculations? The existing system is over 15 years old so there must be some difference in maintenance costs. There should be a way to reuse existing equipment or ductwork to hold the construction costs down and still obtain energy savings. Please look at other alternatives.	#30 "A" A/E WILL RE-EVALUATE AND COORDIN. WITH LARRY STILLWAGON.
ECO 24	31	#31 Where does the increase in natural gas consumption come from? I don't understand. If we are using a 150 ton electric chiller instead of a 450 ton electric chiller where is the gas going. Is this the same as ECO 12?	GAS INCREASE DUE TO COMP ROUND-OFF. CH INSIGNIFICANT. DELETE FROM FURTHER CALC
ECO 27a & 27b	32	How would it change by going to the same type window that was cost effective in ECO 5, building 600. The current windows are shaded by trees and almost all of them have some type of curtain. I don't understand how the lost solar gain, as compared to existing windows with shades, through the tinted windows can offset the reduction in heat loss from having better windows. Half of the windows are on the north side of the building and the coldest temperatures are during the non-daylight hours. Maybe you should be looking at untinted windows, maybe we could use windows with blinds like the ones installed in Phases II and III of the E/M repair project. Recheck.	#32 ECO W DISCUSSED - AGREED TO DELETE FRO. FURTHER CONSIDERATIO
ECO 29	33	I don't understand this ECO. What went into the cost analysis? The current windows have shades, continuous overhangs, and are on east and west elevations so I don't understand how solar gain would outweigh 119 insulated	#33 "A" A/E WILL R EVALUATE W 50% SINGLE GLAZE AND DOUBLE GLA

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

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SUSPENSE DATE:__________

Comments by: Larry Stillwagon

Division: DEH-EE

Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
		panels when the winter heating season average temperatures are low and coldest temperatures occur at night. Maybe the insulated panels need to be thicker than 1" so the ECO would be cost effective. Recheck.	
ECO 36, P 568	34	These calculations are the same as the design for the new tanks installed during the E/M repair project. I have to assume that 120 gallons/day/person for a hospital takes into consideration food services so if we get the hot water for the kitchen from a different source then the existing hot water system no longer has to provide it. Based upon your experience in other hospitals and design guidance in the National Standard Plumbing Code (referenced in Architectural and Engineering Instructions - Design Criteria, 14 July 1989) do you feel that it would still be necessary to continue operating all four of the hot water storage tanks if we were supplying hot water to the kitchen from an alternate source?	#34 "A" A/E WILL RE EVALUATE US. 1990 NATIONAL STANDARD PLUMBING COL AND NEW A/ INSTRUCTIONS FROM BOB MILLER.
ECO 37	35	The simple payback confuses me. I don't understand using the first year fuel cost as the numerator of the equation. Fuel costs, maintenance costs, savings, etc. should be part of the energy or nonenergy savings (+)/ cost (-). The numerator should be those first costs that would enable us to operate the generators for peak shaving. The use of emergency generators for peak shaving usually requires implementation costs for changes so that the generators can supply power to noncritical loads because the normal power is usually the more reliable power. There would also be costs associated with obtaining a signal from the substation so that we would know when the peak was coming so that we could bring the units on line. Did the	#35 - "A" A/E WILL RE-EVALUATE PREPARE SH ANALYSIS. FU. IS OPERATING COST. ADDITI MONTHLY DA FROM KPL K BE ANALYIZE ATTACHED CA PROVIDE LARRY STILL WAS DISCUSS

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: CEMRK-ED-MF

Plans & Specifications / Design
_ Concept _ Final X Other: INTERIM SUBMITTAL
Designed by:
X A/E _ Dist _ DFE

PROJECT: DACA41-90-C-0114
IACH EEAP

SUSPENSE DATE: ________

Comments by: Larry Stillwagon
Division: DEH-EE
Date: 30 May 91

REFERENCE	ITEM	COMMENT	ACTION
		savings calculations include the capacity charges and the energy charges? In your text you mentioned that the electrical chillers were being run for the base load and the steam driven chillers were brought on line last. Did you calculate what the savings would have been if we did it the other way around? I know you are looking at this in ECO 13 but it might help convince the operators to run them this way and to make sure that they are maintained operational so that we can save money.	

BASE YEAR MONTHLY ELECTRICAL CONSUMPTION AND COST
ANZIO & HOSPITAL SUBSTATIONS COMBINED

DATE	KVA (DEMAND)	KWH (USAGE)	SEPARATE TOTAL	COMBINED TOTAL	DIFFERENCE
10/89	30,915	11,690,400	$482,691.60	$479,444.79	$3,246.81
11/89	30,796	11,551,200	$478,499.09	$474,881.27	$3,617.82
12/89	31,620	13,534,800	$538,405.76	$533,959.17	$4,446.59
1/90	32,229	14,528,400	$570,294.27	$564,162.67	$6,131.60
2/90	30,652	13,735,200	$539,645.33	$534,006.87	$5,638.46
3/90	30,740	11,800,800	$485,543.00	$481,827.69	$3,715.31
4/90	30,587	12,858,000	$512,550.69	$510,265.17	$2,285.52
5/90	31,077	10,609,200	$449,318.94	$448,984.94	$334.00
6/90	36,368	13,844,000	$566,930.88	$566,626.96	$303.92
7/90	39,265	18,878,400	$719,224.90	$718,237.69	$987.21
8/90	36,496	14,437,200	$584,280.14	$584,334.23	($54.09)
9/90	38,894	18,958,800	$719,324.00	$718,351.79	$972.21
				TOTAL	$31,625.35

PEAK ELECTRICAL DEMAND - 7/16/90 TO 8/15/90
ANZIO SUBSTATION AND FT RILEY HOSPITAL COMBINED

Sorted by Peak Total KW

7/19/90 TIME	IACH KW	ANZIO KW	TOTAL KW	7/19/90 TIME	IACH KW	ANZIO KW	TOTAL KW
0 :30D	2704	19998	22702	15 :30D	3864	30312	34176 PEAK
1 :00D	2672	18828	21500	15 :00D	3903	30096	33999
1 :30D	2665	18270	20935	16 :00D	3694	30024	33718
2 :00D	2663	17910	20573	14 :30D	3912	29610	33522
2 :30D	2637	17334	19971	14 :00D	3899	29574	33473
3 :00D	2629	16704	19333	13 :30D	3873	29322	33195
3 :30D	2627	16578	19205	13 :00D	3834	29034	32868
4 :00D	2411	16578	18989	16 :30D	3402	29142	32544
4 :30D	2465	16614	19079	12 :30D	3819	28674	32493
5 :00D	2516	16650	19166	12 :00D	3873	28368	32241
5 :30D	2538	16938	19476	17 :00D	3184	28836	32020
6 :00D	2637	17604	20241	11 :30D	3808	28044	31852
6 :30D	2786	18054	20840	17 :30D	3132	28620	31752
7 :00D	2959	18648	21607	18 :00D	3059	28512	31571
7 :30D	3149	19818	22967	18 :30D	3059	28098	31157
8 :00D	3473	21456	24929	19 :00D	3041	27594	30635
8 :30D	3555	22302	25857	19 :30D	3005	27090	30095
9 :00D	3570	23292	26862	20 :00D	2940	26442	29382
9 :30D	3642	24282	27924	10 :00D	3666	25308	28974
10 :00D	3666	25308	28974	20 :30D	2888	25902	28790
10 :30D	3756	16542	20298	9 :30D	3642	24282	27924
11 :00D	3806	20844	24650	21 :00D	2871	24156	27027
11 :30D	3808	28044	31852	9 :00D	3570	23292	26862
12 :00D	3873	28368	32241	21 :30D	2866	23850	26716
12 :30D	3819	28674	32493	22 :00D	2838	23274	26112
13 :00D	3834	29034	32868	8 :30D	3555	22302	25857
13 :30D	3873	29322	33195	22 :30D	2786	22266	25052
14 :00D	3899	29574	33473	8 :00D	3473	21456	24929
14 :30D	3912	29610	33522	11 :00D	3806	20844	24650
15 :00D	3903	30096	33999	23 :00D	2836	20880	23716
Peak 15 :30D	3864	30312	34176	7 :30D	3149	19818	22967
16 :00D	3694	30024	33718	0 :30D	2704	19998	22702
16 :30D	3402	29142	32544	23 :30D	2827	19656	22483
17 :00D	3184	28836	32020	7 :00D	2959	18648	21607
17 :30D	3132	28620	31752	1 :00D	2672	18828	21500
18 :00D	3059	28512	31571	24 :00D	2773	18576	21349
18 :30D	3059	28098	31157	1 :30D	2665	18270	20935
19 :00D	3041	27594	30635	6 :30D	2786	18054	20840
19 :30D	3005	27090	30095	2 :00D	2663	17910	20573
20 :00D	2940	26442	29382	10 :30D	3756	16542	20298
20 :30D	2888	25902	28790	6 :00D	2637	17604	20241
21 :00D	2871	24156	27027	2 :30D	2637	17334	19971
21 :30D	2866	23850	26716	5 :30D	2538	16938	19476
22 :00D	2838	23274	26112	3 :00D	2629	16704	19333
22 :30D	2786	22266	25052	3 :30D	2627	16578	19205
23 :00D	2836	20880	23716	5 :00D	2516	16650	19166
23 :30D	2827	19656	22483	4 :30D	2465	16614	19079
24 :00D	2773	18576	21349	4 :00D	2411	16578	18989

CALCULATED TOTAL WITH DEMANDS ADDED

	ANZIO 1990 AUG ACTUAL	IACH 1990 AUG ACTUAL	SUM 1990 AUG ACTUAL	COMBINED 1990 AUG ACTUAL
BASE CASE				
CAPACITY (KW)	30312	3972	34284	34284
POWER FACTOR (%)	93.20%	100.00%	-	93.94%
CAPACITY (KVA)	32524	3972		36496
SUMMER PEAK (KVA)	35129	4136		35129
80% SUMMER PEAK (KVA)	28103	3309		28103
CONTRACT MINIMUM (KVA)	14643	2500		17143
BILLING CAPACITY (KVA)	32524	3972	36496	36496
200 KVA @ $4.45	$890.00	$890.00		$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00		$1,700.00
REMAINING @ $4.05	$129,292.20	$13,656.60		$145,378.80
SUB DISCOUNT $.20	($6,504.80)	$.00		($7,299.20)
CAPACITY CHARGE	$125,377.40	$16,246.60	$141,624.00	$140,669.60
TOTAL ENERGY (KWH)	12,390,000	2,047,200	14,437,200	14,437,200
50*KVA @ $.03726	$60,592.21	$7,399.84		$67,992.05
100*KVA @ $.03206	$104,271.94	$12,734.23		$117,006.18
250*KVA @ $.02886	$216,779.00	$28,657.98		$258,666.41
EXCESS @ $.02666	$.00	$12,220.94		$.00
ENERGY CHARGE	$381,643.16	$61,012.99	$442,656.15	$443,664.63
TOTAL CHARGE LESS ECA	$507,020.56	$77,259.59	$584,280.15	$584,334.23
ENERGY COST ADJUSTMENT	$26,266.80	$4,340.06	$30,606.86	$30,606.86
TOTAL AMOUNT DUE	$533,287.36	$81,599.66	$614,887.02	$614,941.10

TOTAL SAVINGS = (SUM) TOTAL - (COMBINED) TOTAL = ($54.08)

CALCULATED TOTAL WITH ACTUAL DEMAND

	ANZIO 1990 AUG ACTUAL	IACH 1990 AUG ACTUAL	SUM 1990 AUG ACTUAL	COMBINED 1990 AUG ACTUAL
BASE CASE				
CAPACITY (KW)	30312	3972	34284	34176
POWER FACTOR (%)	93.20%	100.00%		93.20%
CAPACITY (KVA)	32524	3972		36670
SUMMER PEAK (KVA)	35129	4136		35129
80% SUMMER PEAK (KVA)	28103	3309		28103
CONTRACT MINIMUM (KVA)	14643	2500		17143
BILLING CAPACITY (KVA)	32524	3972	36496	36670
200 KVA @ $4.45	$890.00	$890.00		$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00		$1,700.00
REMAINING @ $4.05	$129,292.20	$13,656.60		$146,083.50
SUB DISCOUNT $.20	($6,504.80)	$.00		($7,334.00)
CAPACITY CHARGE	$125,377.40	$16,246.60	$141,624.00	$141,339.50
TOTAL ENERGY (KWH)	12,390,000	2,047,200	14,437,200	14,437,200
50*KVA @ $.03726	$60,592.21	$7,399.84		$68,316.21
100*KVA @ $.03206	$104,271.94	$12,734.23		$117,564.02
250*KVA @ $.02886	$216,779.00	$28,657.98		$257,913.16
EXCESS @ $.02666	$.00	$12,220.94		$.00
ENERGY CHARGE	$381,643.16	$61,012.99	$442,656.15	$443,793.39
TOTAL CHARGE LESS ECA	$507,020.56	$77,259.59	$584,280.15	$585,132.89
ENERGY COST ADJUSTMENT	$26,266.80	$4,340.06	$30,606.86	$30,606.86
TOTAL AMOUNT DUE	$533,287.36	$81,599.66	$614,887.02	$615,739.76

TOTAL SAVINGS = (SUM) TOTAL - (COMBINED) TOTAL = ($852.74)

CALCULATED TOTAL WITH ACTUAL DEMAND AND ASSUMED POWER FACTOR

	ANZIO 1990 AUG ACTUAL	IACH 1990 AUG ACTUAL	SUM 1990 AUG ACTUAL	COMBINED 1990 AUG ACTUAL
BASE CASE				
CAPACITY (KW)	30312	3972	34284	34176
POWER FACTOR (%)	93.20%	100.00%		93.94%
CAPACITY (KVA)	32524	3972		36381
SUMMER PEAK (KVA)	35129	4136		35129
80% SUMMER PEAK (KVA)	28103	3309		28103
CONTRACT MINIMUM (KVA)	14643	2500		17143
BILLING CAPACITY (KVA)	32524	3972	36496	36381
200 KVA @ $4.45	$890.00	$890.00		$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00		$1,700.00
REMAINING @ $4.05	$129,292.20	$13,656.60		$144,913.05
SUB DISCOUNT $.20	($6,504.80)	$.00		($7,276.20)
CAPACITY CHARGE	$125,377.40	$16,246.60	$141,624.00	$140,226.85
TOTAL ENERGY (KWH)	12,390,000	2,047,200	14,437,200	14,437,200
50*KVA @ $.03726	$60,592.21	$7,399.84		$67,777.80
100*KVA @ $.03206	$104,271.94	$12,734.23		$116,637.49
250*KVA @ $.02886	$216,779.00	$28,657.98		$259,164.24
EXCESS @ $.02666	$.00	$12,220.94		$.00
ENERGY CHARGE	$381,643.16	$61,012.99	$442,656.15	$443,579.53
TOTAL CHARGE LESS ECA	$507,020.56	$77,259.59	$584,280.15	$583,806.38
ENERGY COST ADJUSTMENT	$26,266.80	$4,340.06	$30,606.86	$30,606.86
TOTAL AMOUNT DUE	$533,287.36	$81,599.66	$614,887.02	$614,413.25

TOTAL SAVINGS = (SUM) TOTAL - (COMBINED) TOTAL = $473.77

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: Larry Stillwagon

Plans & Specifications / Design
__ Concept __ Final x Other

PROJECT: IACH EEAP Study
Interim Submittal

Designed by:
x A/E __ Dist __ DFE

SUSPENSE DATE: ________

Comments by:
Russ Goering

Division:
DEH-ED

Date:
6 Jun 91

REFERENCE	ITEM	COMMENT	ACTION
ECO #2	1	Need to have all costs considered in a life cycle cost (LCC) analysis. Existing lines are 32 years old so they must be nearing the end of their useful life. Need maintenance cost included also. We need the LCC analysis for project justification even if these ECO cannot be justified on energy savings alone.	#1 "A" A/E WILL PROVI RE-EVALUATION W LIFE CYCLE COST
General	2	It seems to just make sense that some of these ECO's should have been considered in combination, e.g., consider a smaller boiler in 615 in conjunction with modular boilers in 610, 620, and 621. It would seem more economically feasible that way than evaluating each ECO separately.	#2 "A" SEE STILLWAGON COMMENTS. RE-EVALUATION WILL COMBINE ECO'S
ECO #4	3	Need life cycle costs to include maintenance cost for periodic recalibration of added points, particularly flue gas sensors.	#3 "A" SEE COMMENT NUMBER 1 A
ECO #6	4	Need life cycle costs to include maintenance and recalibration. Also, this ECO needs to be annualized for the entire project which requires an cost estimate and estimated savings for the entire system, not 'per trap'. A 'per trap' analysis would not seem to be valid unless each trap is expected to fail annually. It would seem that an estimated number of traps failing each year would be required.	#4 "D" COMMENT WAS WITHDRAWN. E WAS DELETED PREVIOUS COMM
ECO #9	5	Were other heat recovery options, e.g., indirect air-air heat exchanger or air-air heat pump considered?	#5 A/E WILL PROVIDE NARRA EXPLAINING OPTI
ECO #10	6	What is the 80% efficiency? Isn't it input power that is desired from the calculation? Also, if 5935 represents the total number of hours that the pump runs, isn't it <u>required</u> some of that time, and only runs <u>unnecessarily</u> the remainder of that time?	#6 "A" A/E WILL RE-EVALUATE. SEE STILLWAGON CO 16 AND 17.

PAGE 1 OF 3

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: Larry Stillwagon

Plans & Specifications / Design
__ Concept __ Final x Other

PROJECT: IACH EEAP Study Interim Submittal

Designed by:
x A/E __ Dist __ DFE

SUSPENSE DATE:________

Comments by: Russ Goering

Division: DEH-ED

Date: 6 Jun 91

REFERENCE	ITEM	COMMENT	ACTION
	7	The reference on page 275-276 regarding a flow balance problem in the 1975 Addition has been previously corrected by closing the bypass lines on the 3-way valves.	#7 "NOTED" - SE STILLWAGON COM 16.
ECO #11	8	What about using this system to preheat boiler makeup water?	#8 "NOTED" - SEE STILLWAGON COM. 19.
ECO #12	9	Is the only energy savings considered in this analysis due to the increased efficiency as suggested on pg. 288? What about the reduced steam load from not having to run the steam driven chiller? This might be a good candidate for analysis in conjunction with a reduced size boiler.	#9 "NOTED" - STILLWAGON COM 20.
General	10	As done in ECO #12, computer output is not acceptable proof of anything without knowing what the input was, i.e., what assumptions were made, etc.	#10 "A" A/E AGREE TO EXPA NARRATIVE TO INCLUDE ASSUMP
ECO #13,	11	Need LCC analysis. Surely new chillers would require less maintenance and repair than 36 year old chillers! The existing chillers would probably require replacement in a LCC analysis also.	#11 LIFE CYCLE COST NOT REQU
ECO #14	12	20,000 MBH seems large for an off-peak boiler since only one of the existing 33,440 MBH boilers is loaded about 70% maximum at any time(per pg. 344). 20,000 MBH would nearly meet peak requirement.	#12 "A" A/E AGREE TO RE EVALUATE.
ECO #18	13	Need LCC analysis including maintenance costs.	#13 SEE COMM 11 ABOVE.
ECO #21	14	See comment #7.	#14 "NOTED" - STILLWAGON COM 16.

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: Larry Stillwagon

Plans & Specifications / Design
__ Concept __ Final x Other
Designed by:
x A/E __ Dist __ DFE

PROJECT: IACH EEAP Study
Interim Submittal

SUSPENSE DATE: ________

Comments by: Russ Goering

Division: DEH-ED

Date: 6 Jun 91

REFERENCE	ITEM	COMMENT	ACTION
ECO #22a & b	15	Savings is calculated as $/yr/fixture. Need to know approx. how many fixtures to know total savings and total project cost.	#15 "NOTED" - SE STILLWAGON COMM. 29.
ECO #23	16	Need LCC analysis including maintenance, repair, and replacement costs.	#16 LIFE CYCLE COST NOT REQUI
	17	Are min. ventilation requirements for the types of spaces served taken into consideration on the VAV alternatives analyzed?	#17 YES - VAV CONSIDERATIONS DEFINED IN NARRATIVE.
ECO #25a & b	18	Need LCC analysis including maintenance, repair, and replacement costs.	#18 LIFE CYCLE COST NOT REQUI
ECO #30a & b	19	Another case where only computer output is shown and not input or assumptions. I'm curious why adding insulation to an uninsulated wall has such a small effect on energy consumption.	#19 A/E WILL EXPAND NARRAT TO INCLUDE ASSUMPTIONS. S IS 18%.
ECO 36	20	This analysis does not seem fair. It appears that the existing Dom. HW system does not have the capacity to meet the total calculated building load. The total capacity of the existing system is needed just to meet the occupancy load, so really what this analysis is comparing is instantaneous Dom. HW to meet kitchen load vs. not meeting kitchen load.	#20 "NOTED" SEE STILLWAGO COMMENT 34.

PAGE 3 OF 3

)

1. Their Remarks: Stated cooling capacity does not exceed 950 Tons. "A" - A/E AGREES.
NOT TRUE COMPUTER CALCULATED LOAD IS BASED ON AVERAGE WEATHER TAPE. ACTUAL LOAD EXCEEDS 950 TONS IS UNDERSTOOD.

2. PAGE 307-311 Use one 600 Ton Variable drive York(most efficient on market today)staged on first, also more efficient to use in winter due to lower load requirements and variable drive.Construction cost probably 30 to 35 percent as to what is on page 307. Annual savings would be higher.Factor in high cost of repair and maintenance on 36 year old turbines and payback years decreases dramatically. You also have to consider that failure and downtime causes loss of ability to cool Hosp. adequately.Chances of failure of new equipment is reduced. Annual savings would be more than $12,000yr. We spend more than that now trying to keep old machines operating. "NOTED" - SEE STILLWAGON COMMENT 21. A/E WILL RE-EVALUATE.

3. We do not use continuous blowdown all the time.We also have a good chemical treatment ~~rather~~ excellent treatment program in place now. Page 336 assumes blowdown of 46 GPM. Take that time 60 time 24 and it equals 6624 gals. per day. We only use 1,000 to 2000 per day now. That proves their blowdown assumption does not work. "NOTED" A/E WILL RE-EVALUATE BASED ON MANUAL BLOWDOWN.

4. Page 414 -419 Was present energy use calculated?? WE run Trane, pumps, cooling towers, cost of chemical treatment included?? ALL ENERGY WAS INCLUDED EXCEPT CHEM. TREATMENT COST/ ENERGY.

5. They said they checked with OPERATORS to learn. Yet no one here remember anyone asking the questions they have an answer for??? VOLUME THREE "SURVEY AND SUPPORTING DATA" INCLUDED SITE VISIT DATES AND NAMES OF PERSONNEL CONTACTED. A/E WILL ATTEMPT TO IMPROVE PUBLIC RELATIONS WITH OPERATING PERSONNEL.

File: C:\ARMS\ARMSWORD\IAHEEAFR.CMT
Printed: Tuesday May 21, 1991 at 4:01:06 p.m.

Project Info: ENERGY ENGINEERING ANAL. PROG. FORT RILEY, KANSAS - INTERIM

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail	ACTION
1	DIAL	ED-DM	DA-23,24	MEC		"A"- LIST IS PART OF CONTRACT. SEE Pg. 23.
	Is this list of "Energy Conservation Opportunities" a general list applicable to any building rather than specific ECO's meant to be analyzed for these buildings? It is a much longer list than the ones actually considered for this project and obviously not all were considered.					
2	DIAL	ED-DM	DA-39	MEC		"A"- LIST IS PART OF CONTRACT DOCUMENTS
	This list of applicable documents is incomplete. A number of ETL's shown in par. 5.c on page 36 is missing. Also, there is no heading on this sheet of the first paragraph. It looks as though there may have been a sheet ahead of this which is missing.					
3	DIAL	ED-DM	DA-60	MEC		"A"- AIR HAND HAVE STEAM HEAT COILS. NARRATIVE WIL BE REVISED.
	The middle paragraph does not mention that these AHU's also have steam preheat coils.					
4	DIAL	ED-DM	DA-98	MEC	PAR-3	"A"
	One thing which was not considered in this analysis was the reduction of boiler efficiency in the main plant as a result of reduced boiler load coincident with installing a new boiler in Building 610. However, this ECO was dropped out on the basis of inadequate payback anyway so no problem.					
5	DIAL	ED-DM	DA-111	MEC		"A"- NARRATIVE WILL BE EXPANDED
	The chilled water source was not mentioned here.					
6	DIAL	ED-DM	DA-116	MEC		"A"
	Similar to Item #4 above.					
7	DIAL	ED-DM	DA-196	MEC		"A"- CHANGE INSIGNIFICANT
	In the annual dollar saving calculation, 81 MCF is actually a MBTU figure and should be 78.6 MCF. However, this will not change the results so as to qualify the ECO so no problem.					
8	DIAL	ED-DM	DA-131	MEC		"A"- UNIT S-8 IS IDENTIFIE ON Pg. 132 TRACE 600 Z #506
	Unit S-8 is not included on this list.					
9	DIAL	ED-DM	DA-204	MEC		"A"- CHANGE INSIGNIFICAN
	Similar to Item #7 above.					
10	DIAL	ED-DM	DA-235	MEC		

File: C:\ARMS\ARMSWORD\IAHEEAFR.CMT
Printed: Tuesday May 21, 1991 at 4:01:48 p.m.

Project Info: ENERGY ENGINEERING ANAL. PROG. FORT RILEY, KANSAS - INTERIM

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail	ACTION
	This does not show how the MCF and KWH figures used in the calculations were obtained from the TRACE printout T0045080.					"A"- EXPLANATI WILL BE PROV.
11	DIAL	ED-DM	DA-250	MEC		"NOTED" SEE STILLWAGON COMMENTS.
	Not all steam traps appear to be included here. There are alot of these on the 3rd floor AHU's, in the 1975 Addition.					
12	DIAL	ED-DM	DA-514	MEC		"A"
	Step 10, Total Project Cost should be $9,176 rather than $9,676.					
13	DIAL	ED-DM	DA-527,532	MEC		"A"- COST DIF. BETWEEN 15 16 SHOWER H IS INSIGNIFICA
	How can these cost estimates be the same when this involves a different number of shower heads?					
14	DIAL	ED-DM	DA-614	MEC		"A"- A/E WIL REVISE TO -1 WITH EXPLAN
	Where does the winter design temperature of -10 degF come from? This is supposed to be -1 degF as you have shown elsewhere.					
15	DIAL	ED-DM	DA-628	MEC		"A"- TRA K IS FOR BAS. BLDG.
	This sheet does not show the ECO number.					
16	DIAL	ED-DM	DA-637	MEC		"A"- ORIGINAL PAGES 147 7 159 WERE OMITTED FR SOME REPOR WHICH EXPLA METHODOLOGY
	The calculation sheets for this ECO do not show how the TRACE figures were utilized. Also, where is the summary of the methodology as stated on page 5 pertaining to the TRACE?					

File: A:\IACHFRKS.CMT
Printed: Monday May 20, 1991 at 8:02:29 a.m.

Project Info: Irwin Army Com. Hosp. Ft. Riley Kansas; Energy Eng. Anal. Prog.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	QUILTY	ED-DA	VOL.2-232	ARC	

Caulking work should be included in project description and cost estimate analysis. "A"- CAULKING INCLUDED IN REPLACEMENT COST OF WINDOWS. ALL COST TO BE VARIFIED.

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Printed: Monday July 1, 1991 at 0:23:29 a.m.

Project Info: ENERGY ENGINEERING ANALYSIS IRWIN ARMY COMMUNITY HOSPITAL

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail	
1	GRIGSBY	MRK-ED-DL	VOL1 21 & 24	ELE		EXPLANATION / ON Pg 15 O. VOL. 1. (NOT COST PROJEC
	WHY WAS THE KITCHEN HOOD SHUT OFF (ITEM 33) EXCLUDED FROM THE SUMMARY OF ECIP PROJECTS?					
2	GRIGSBY	MRK-ED-DL	VOL2 388	ELE	ECO 22B	"A"- A/E WI RE-EVALUATI ADDITIONAL INFORMATION REFLECTORS WILL BE PROVIDED.
	THERE IS NOT ENOUGH DATA HERE TO SUPPORT THE CLAIM THAT MODIFYING A 4 LAMP FLUORESCENT FIXTURE WITH A HIGH EFFICIENCY REFLECTOR AND 2 LAMPS WILL PROVIDE THE SAME LIGHT OUTPUT AS THE 4 LAMPS. HOW MUCH LIGHT LOSS WILL THERE BE WHEN THE REFLECTOR BECOMES DIRTY? WHAT ABOUT THE CHANGE IN LIGHT DISTRIBUTION AND COMFORT PROBABILITY? NEED MORE INFORMATION.					

1.8 PREFINAL SUBMITTAL REVIEW CONFERENCE DATA:

A. A prefinal submittal review conference covering Energy Engineering Analysis Program, Irwin Army Community Hospital, Fort Riley, Kansas was accomplished November 26, 1991 at the office of DEH at Fort Riley, Kansas.

B. Annotated review comments are included in this section. A summary of action notations shown on the annotated review comments is as follows:

"A" indicates that the comment was accepted as valid and will be complied with.

"B" indicates that there was disagreement regarding the comment and an explanation has been included as part of this memorandum.

"C" indicates that final resolution of the comment could not be accomplished during the conference and future action will be taken to check and resolve status of the comment.

"D" indicates that the comment was deleted with reason. Reason for deletion is included as part of this memorandum.

C. This paragraph covers review comments. A separate subparagraph is provided for each set of review comments.

1. This subparagraph covers comments dated 30 May 1991 by Larry Stillwagon. Following, in the same order as listed on the attached comments, is the current status of each item.

a. Action notation for this item is "A". A/E will revise energy dollar savings calculations to include energy demand charge and/or time of day savings if applicable. This is a change from previous instructions governing energy dollar savings.

b. Action notation for this item is "A". A/E will revise final submittal narrative to include statement that "pneumatic controls are showing signs of being out of calibration again". It appears that current staffing of the maintenance section is not adequate to maintain the pneumatic control systems properly. DEH is developing a project to replace the controls with ones that will require less maintenance.

c. Action notation for this item is "A". A/E will limit development of ECIP project documentation to 10 years or less. Projects with simple payback greater than 10 years will be developed for other funding programs.

d. Action notation for this item is "A". Final submittal will include documentation either narrative or detailed calculations on all Energy Conservation Opportunities identified in previous submittals.

e. Action notation for this item is "A". A/E agrees that the ECO identifying the elimination of district should be combined with the Off Peak Boiler ECO for the final submittal.

f. Action notation for this item is "A". A/E agrees that ECO #5 should be combined with ECO #20 for the final submittal. Calculations for energy saving dollars will be revised to include reduction in electrical demand.

g. Action notation for this item is "A". A/E agrees with comment. Interim submittal identified potential problems with using 3-way valves as 2-way valves in analysis of ECO #10.

the pitfalls of this conversion are two-fold: (a) causing a 3-way valve to act like a 2-way valve increases power needs for the valve operator, and (b) the 3-way valve stem may not be sturdy enough and well supported for 2-way valve service. Project cost developed for prefinal submittal ECO #23 includes replacement of all 3-way chilled water valves in the 1975 addition.

h. Action notation for this item is "A". A/E agrees that ECO's #15 and #16 should be combined together to form a single project.

i. Action notation for this item is "A". A/E agrees that ECO #17 should be combined with ECO's #15 and #16 to form a project with cost greater than $200,000.

j. Action notation for this item is "A". The analysis of the alternate chiller ECO included heat recovery/waste heat in the energy plant to preheat domestic hot water. This ECO evaluation will be included in the Final Submittal.

k. Action notation for this item is "A". A/E agrees the final submittal calculations will include evaluation of high efficiency 2-speed motors on the 1975 addition air handling units.

l. Action notation for this item is "A". The A/E agrees ECO #37, Peak Shaving, should be dropped from further consideration due to poor payback calculations. All loaned material for use on this project will be returned at project completion.

m. Action notation for this item is "A". The A/E will check and resolve numbers used in ECO #39 calculations.

ENERGY ENGINEERING ANALYSIS PROGRAM

PREFINAL SUBMITTAL

REVIEW CONFERENCE

November 26, 1991

Attendees

Name	Company	Phone
Larry Stillwagon	DEH	913-239-2371
Bob Miller	KCD COE	816-426-7348
Maryhelen Maggard	MNB	816-931-2200
William Bailey	MNB	816-931-2200

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO CEMRK-ED-MF

RECEIVED NOV 27 1991 MASSAGLIA - NEUSTROM - BREDSON, INC. CONSULTING ENGINEERS

Plans & Specifications / Design
_ Concept _ Final X Other: PREFINAL SUBMITTAL

PROJECT: DACA41-90-C-0114
IACH EEAP

Designed by:
X A/E _ Dist _ DFE

SUSPENSE DATE: ____________

Comments by: Larry Stillwagon

Division: DEH-EE

Date: 25 November 91

REFERENCE	ITEM	COMMENT	ACTION
Pg 16, Exec. Summary (ES)	1	All energy $ savings can be included in the economic evaluation. Energy demand charge or time of day savings, if applicable, can be used. This is a change from previous instructions.	"A" - A/E WILL INCLUDE ALL ENERGY $ SAVINGS IN CALCULATIONS.
Pg 188, Vol 2 of 3	2	Mechanical Systems Item 4. The pneumatic controls are showing signs of being out of calibration again. It appears that current staffing of the maintenance section is not adequate to maintain the pneumatic control systems properly. DEH is developing a project to replace the controls with ones that will require less maintenance.	"A" - A/E WILL REVISE FINAL SUBMITTAL NARRATIVE TO INCLUDE THIS STATEMENT.
General	3	Some of the ECOs are recommended for implementation, but the Life Cycle Cost Analysis Summary values do not meet the criteria of Simple payback less than 10 years. Examples: ECO 2 - 13.4 year payback, ECO 26 - 12.8 year payback, and ECO 29 - 17.65 year payback. If the payback on ECOs 26 and 29 can not be lowered to less than 10 years they should be dropped.	"A" - A/E WILL LIMIT ECIP PROJECTS TO 10 YEARS OR LESS. OTHER FUNDING PROGRAMS ARE > 10 YRS
General	4	Several of the ECOs have no notation on them and there is no documentation of what was done on them. Examples: ECO 4, 8, 10, 11, 12, 13, & 16.	"A" - FINAL SUBMITTAL WILL ADDRESS MISSING ECO'S
ECO 2	5	This ECO does not meet ECIP criteria by itself, but this work must be done in conjunction with ECO 14, Off Peak Boiler, so they should be combined for the final submittal.	"A" - A/E AGREES.
ECO 5	6	The payback for this project might improve if the savings due to reduction in electrical demand is added to the energy savings (see comment #1). ECO 20 should be combined with this ECO for the final submittal.	"A" - ECO 5 SAVINGS WILL BE RECALCULATED FOR FINAL SUBMITTAL.

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: CE[illegible] RECEIVED NOV 27 1991

Plans & Specifications / Design
_ Concept _ Final X Other: PREFINAL SUBMITTAL
Designed by:
X A/E _ Dist _ DFE

PROJECT MASSARAGA NEISTROM - KRECOON, INC. CONSULTING ENGINEERS IACH EEAP

SUSPENSE DATE:__________

Comments by: Larry Stillwagon

Division: DEH-EE

Date: 25 November 91

REFERENCE	ITEM	COMMENT	ACTION
ECO 10	7	There was a comment from another AE that using the three-way valves as two-way valves on the 1975 Addition AHU's by closing the bypass valves was probably not giving us the desired results. He said that three-way valves would not shut off completely and that may be the reason the primary/secondary chill water loop system won't control properly (too much flow in the secondary loop). Changing these valves to two-way valves should be considered even if we decide not to change these systems to VAV. Leaking valves would cause energy waste because the supply air is cooler than necessary and the reheats have to supply more heat.	"A" - INTERIM SUBMITTAL IDENTIFIED POTENTIAL PROBLEM WITH 3-WAY VALVE IN ECO 10 EVALUATION. ECO-23 INCLUDES NEW 2-WAY VALVES IN ANALYSIS.
ECO 15/16	8	These two ECO's should be combined.	"A" - A/E AGREES
ECO 17	9	This ECO should be combined with ECO's 15 & 16 so that we will have one ECIP project greater than $200,000.	"A" - A/E AGREES
General	10	I don't see anything in ECO 17 or 35 addressing the comment of mine from the Interim Submittal about using waste heat in the energy plant to preheat domestic hot water. Has this been dropped or is it included in the alternate chiller ECO.	"A" - CHILLER ECO INCLUDED HEAT RECOVER FOR DOMESTIC HOTWATER.
ECO 23	11	This appears to be a good project even though it is almost $1 million when combined with changing the speed controls on the VAV AHUs in the 1955 portion of the hospital. I would like to know what the savings would be if we changed the three-way valves to two-way control valves, changed the motors on the AHUs to high efficiency two speed motors (slow speed during unoccupied times), and repairing the dampers.	"A" - A/E WILL REEVALUATE ECO 23 FOR FINAL SUBMITTAL.

FORT RILEY - FACILITIES ENGINEERS
ENGINEERING REVIEW COMMENTS

TO: CEMRK-ED-MF

Plans & Specifications / Design
_ Concept _ Final X Other: PREFINAL SUBMITTAL

PROJECT: DACA41-90-C-0114
IACH EEAP

Designed by:
X A/E _ Dist _ DFE

SUSPENSE DATE: ________

Comments by:
Larry Stillwagon

Division:
DEH-EE

Date:
25 November 91

REFERENCE	ITEM	COMMENT	ACTION
ECO 37 Page 402 Para 1, 2nd Sen.	12	This sentence says that a demand profile for 1 day is not available, but you should have "loaned" you my copy of the printout from KPL for the hospital substation. I would like it back when you are done with it. This ECO can be dropped.	"A"- A/E AGREES THAT ECO 37 SHOULD BE DROPPED FROM FINAL SUBMITTAL.
ECO 37, 39	13	Check 293, 826.43 does not agree with L. Stillwagon.	"A"- A/E AGREES. FINAL SUBMITTAL WILL RESOLVE

RECEIVED
NOV 27 1991
MASSAGLIA - NEUSTROM - BREDSON, INC.
CONSULTING ENGINEERS

SECTION II - ANALYSIS OF EXISTING CONDITIONS

SECTION II

ANALYSIS OF EXISTING CONDITIONS

2.1 BUILDING DESCRIPTION:

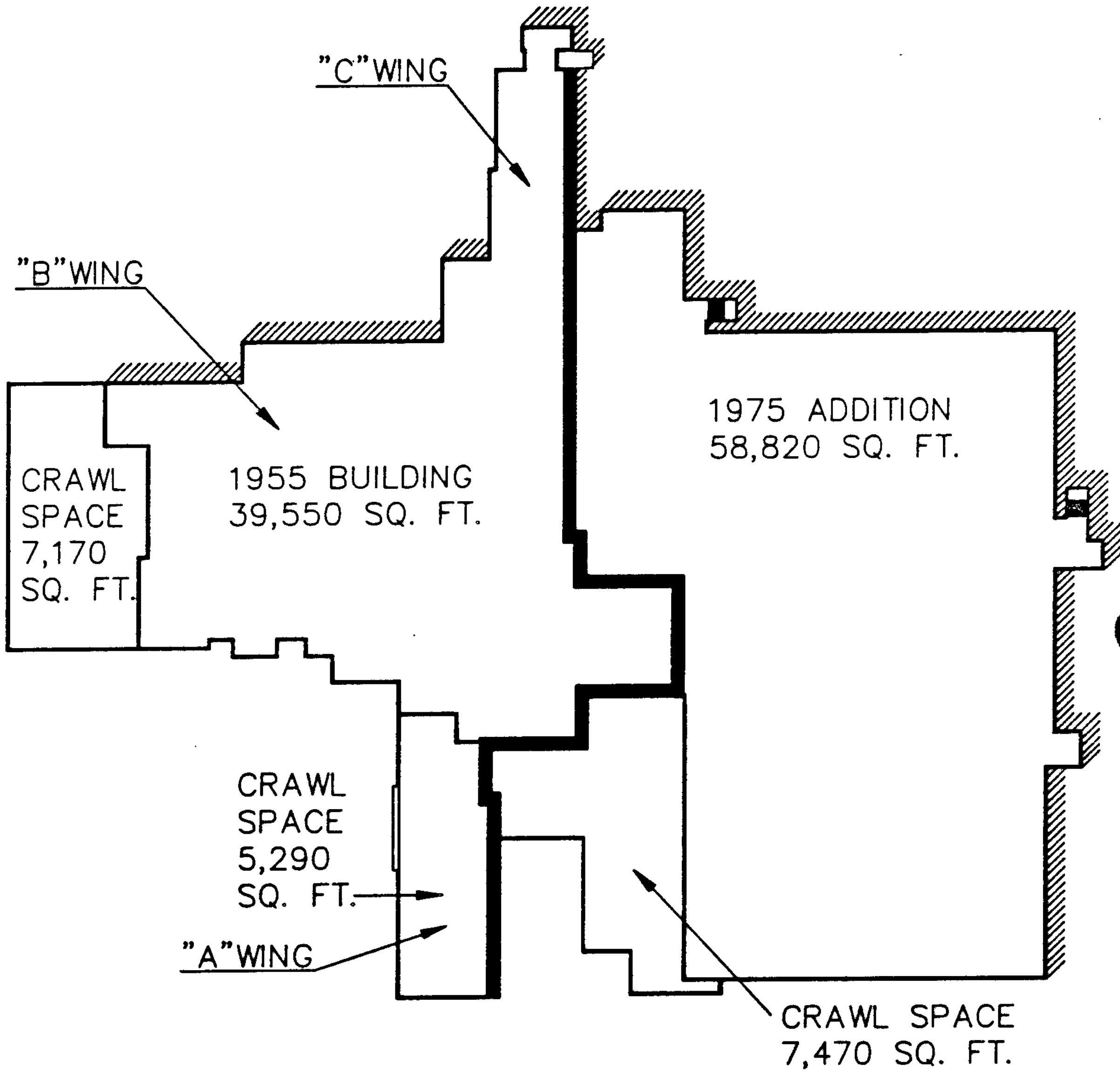
A. BUILDING NO. 600 - HOSPITAL:

Irwin Army Hospital consists of two large building additions; the original hospital dated 1955 and a major expansion which occurred in 1975. The original building received extensive renovations including window replacement work and mechanical/electrical system upgrades in 1985.

The hospital contains approximately 367,000 gross square feet equally distributed between the 1955 and 1975 additions.

Exhibits No. 6 thru 13 illustrate the building's basic floor plan with square footage delineated between 1955 and 1975 buildings.

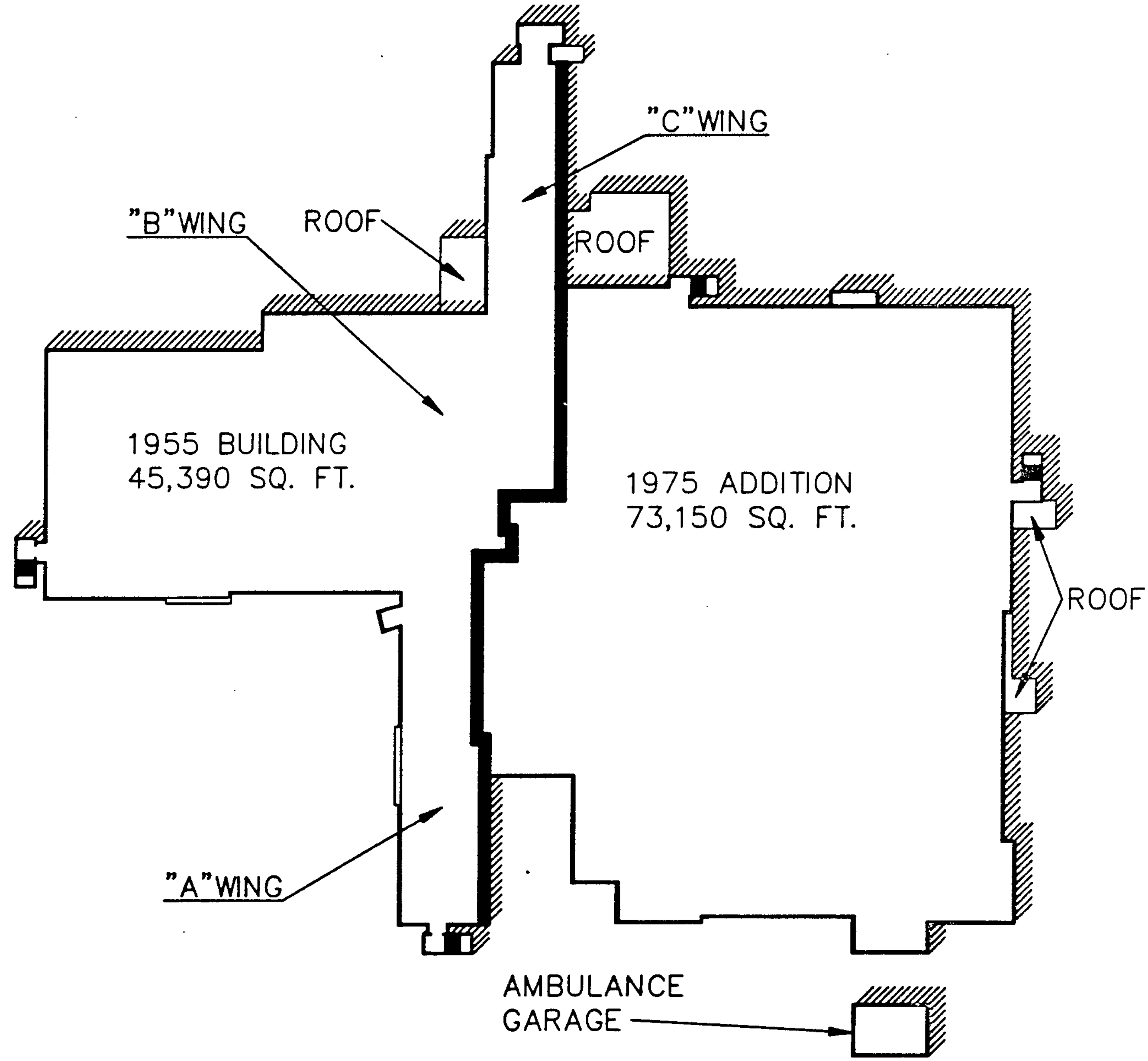
The 1955 building is a basement plus five (5) story reinforced concrete framed structure with face brick and thermally broken aluminum window units between exposed concrete columns and spandrel beams. Window units contain bronze tinted insulated glass panels with



BASEMENT FLOOR PLAN

SCALE : 1"= 80'-0"

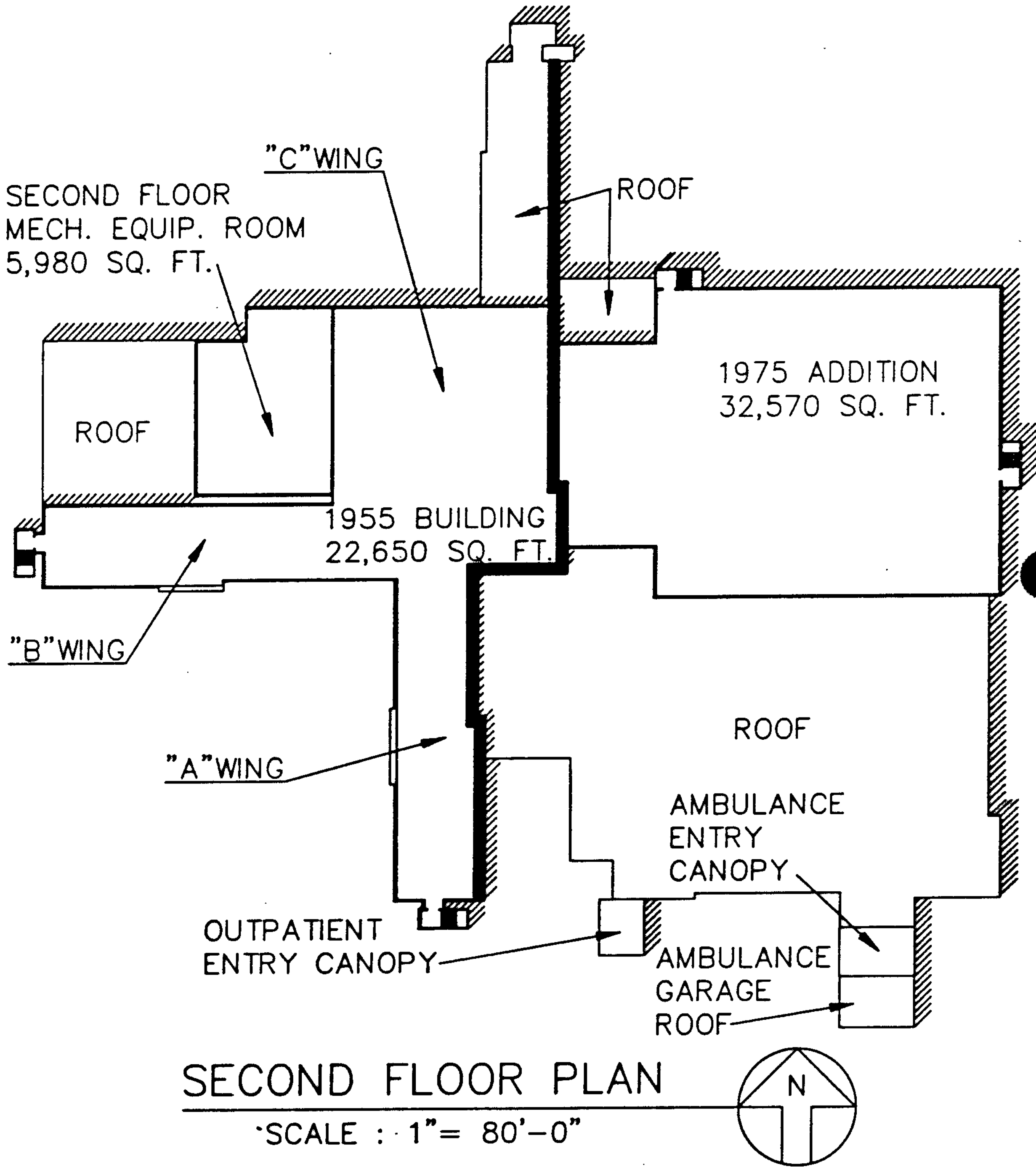
EXHIBIT NO. 6 – BUILDING 600



FIRST FLOOR PLAN

SCALE : 1"= 80'-0"

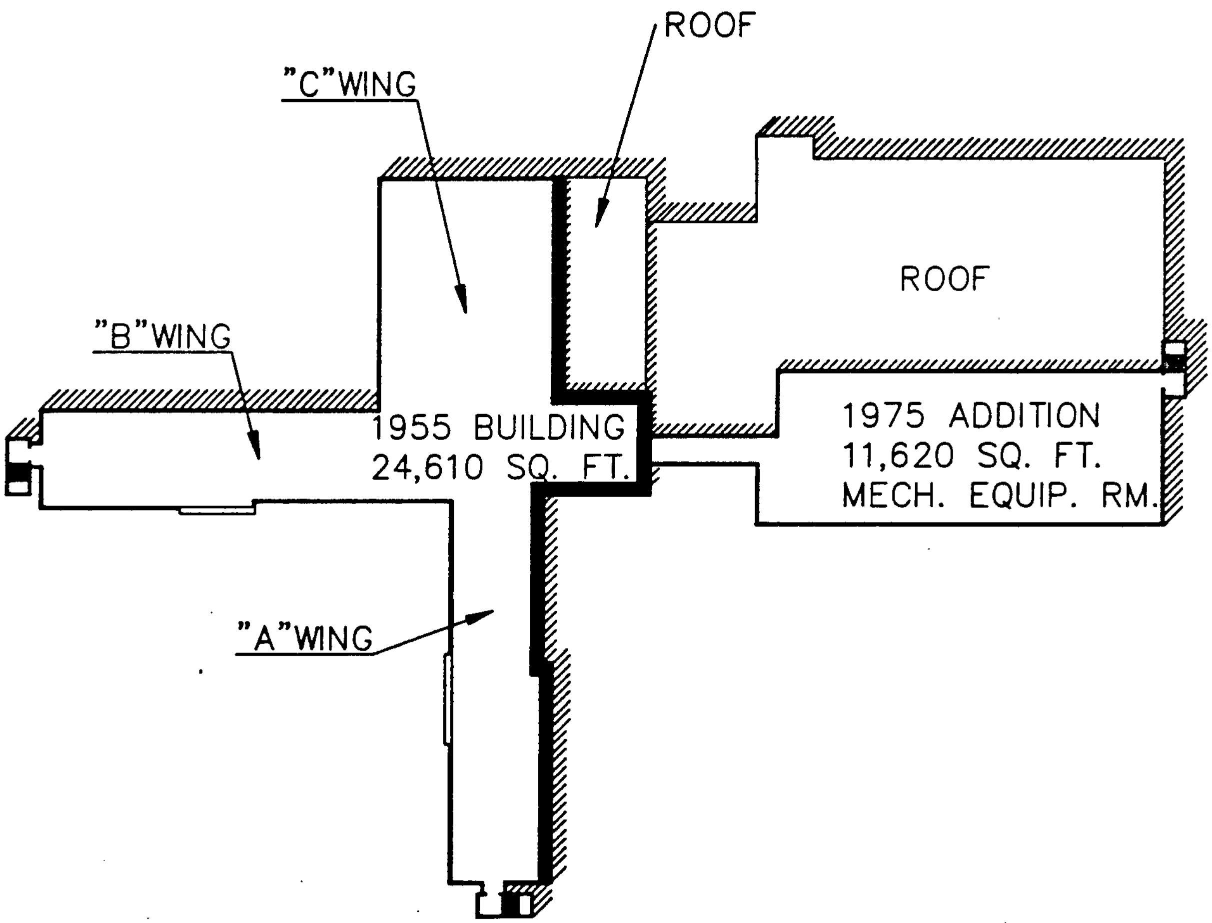
EXHIBIT NO. 7 — BUILDING 600



SECOND FLOOR PLAN

SCALE : 1"= 80'-0"

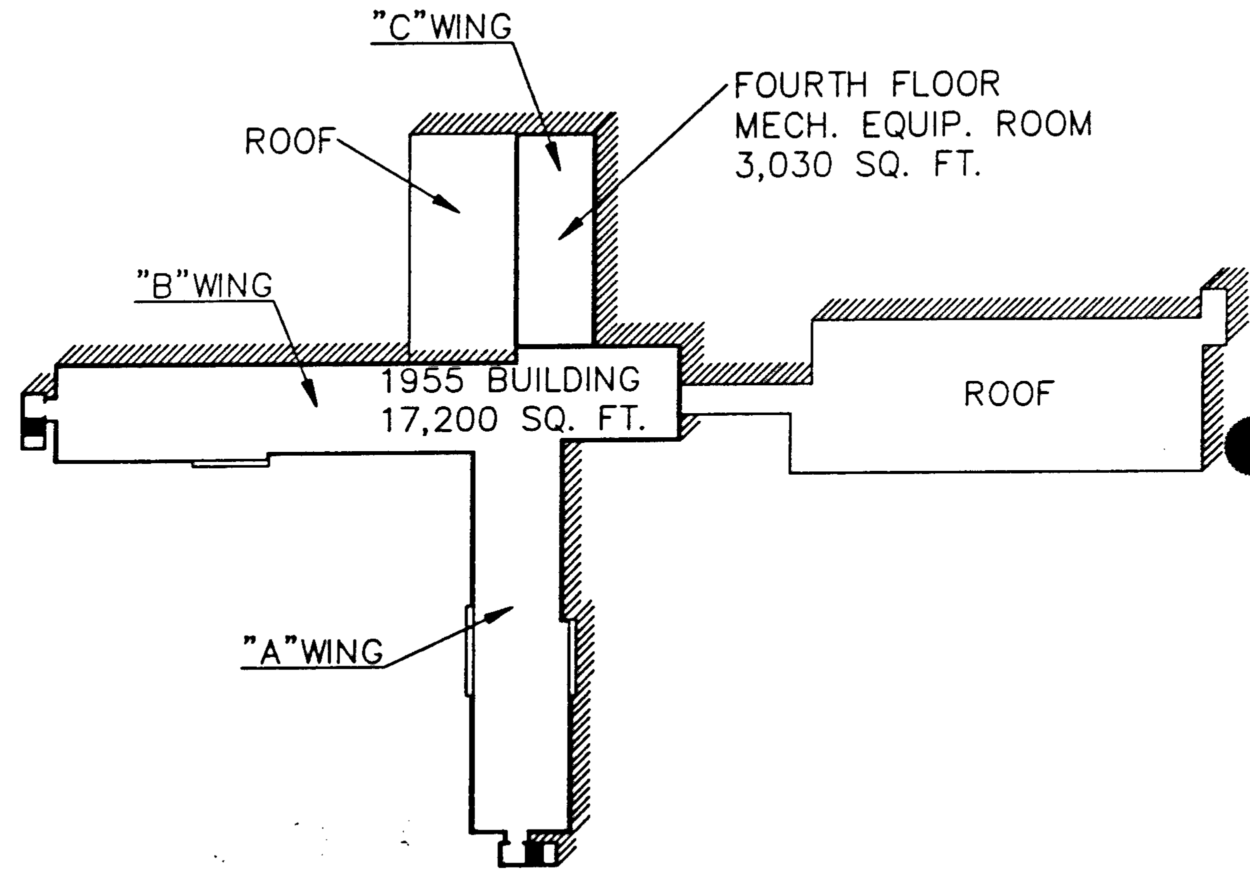
EXHIBIT NO. 8 – BUILDING 600



THIRD FLOOR PLAN

SCALE : 1"= 80'-0"

EXHIBIT NO. 9 — BUILDING 600



FOURTH FLOOR PLAN

SCALE : 1"= 80'-0"

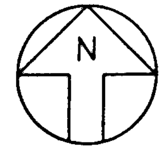
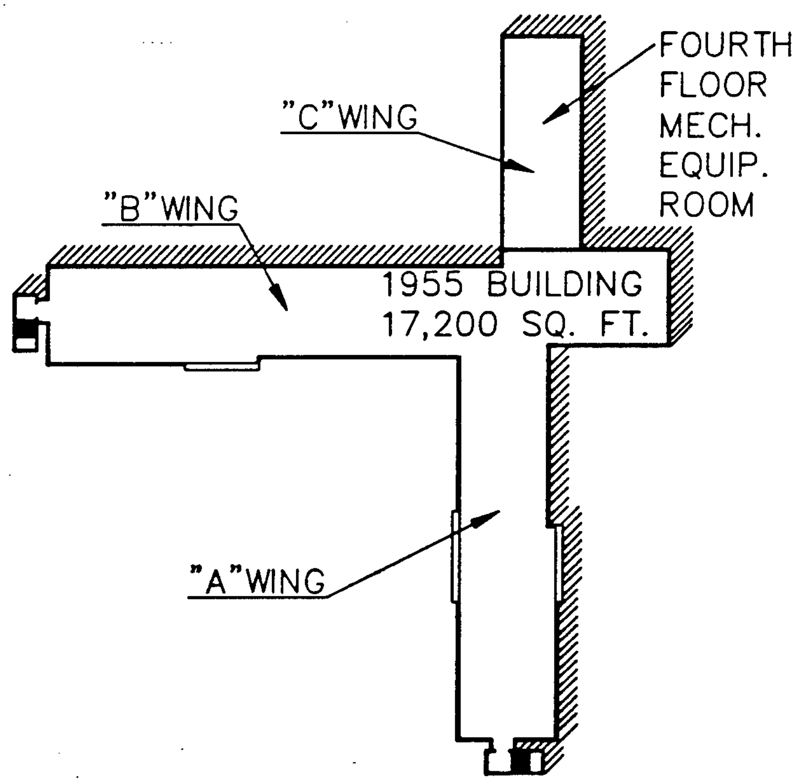


EXHIBIT NO. 10 — BUILDING 600



FIFTH FLOOR PLAN

SCALE : 1"= 80'-0"

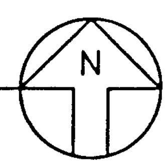
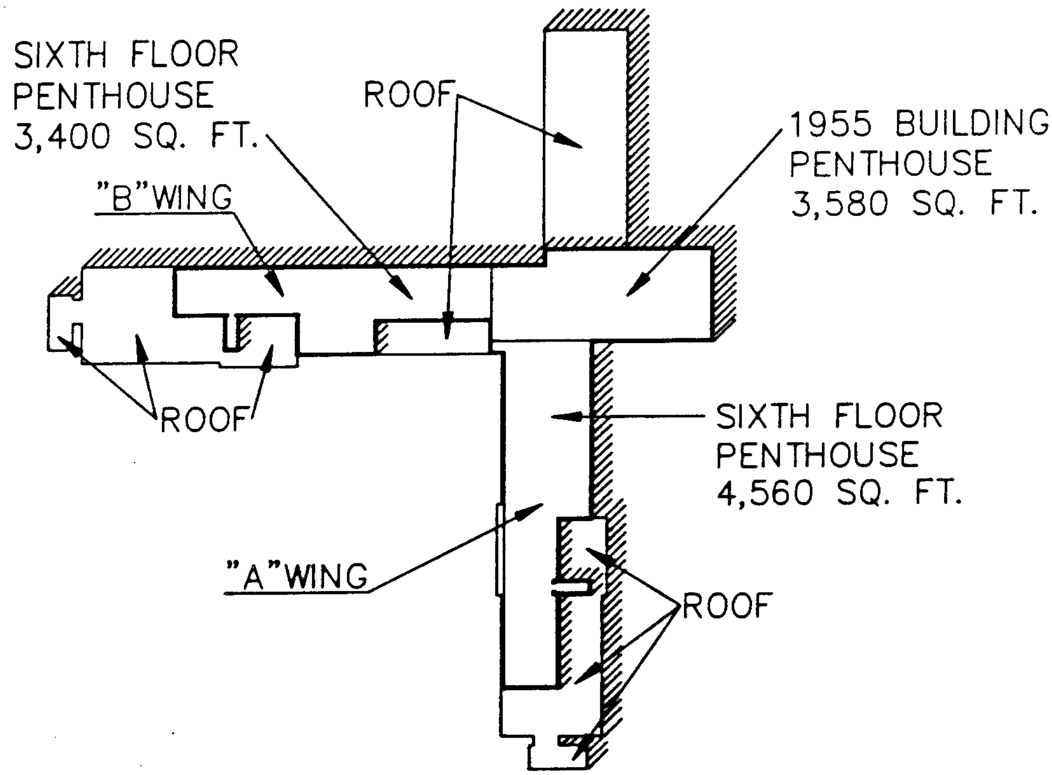


EXHIBIT NO. 11 — BUILDING 600



SIXTH FLOOR PLAN

SCALE : 1"= 80'-0"

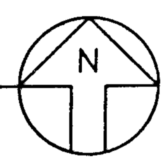
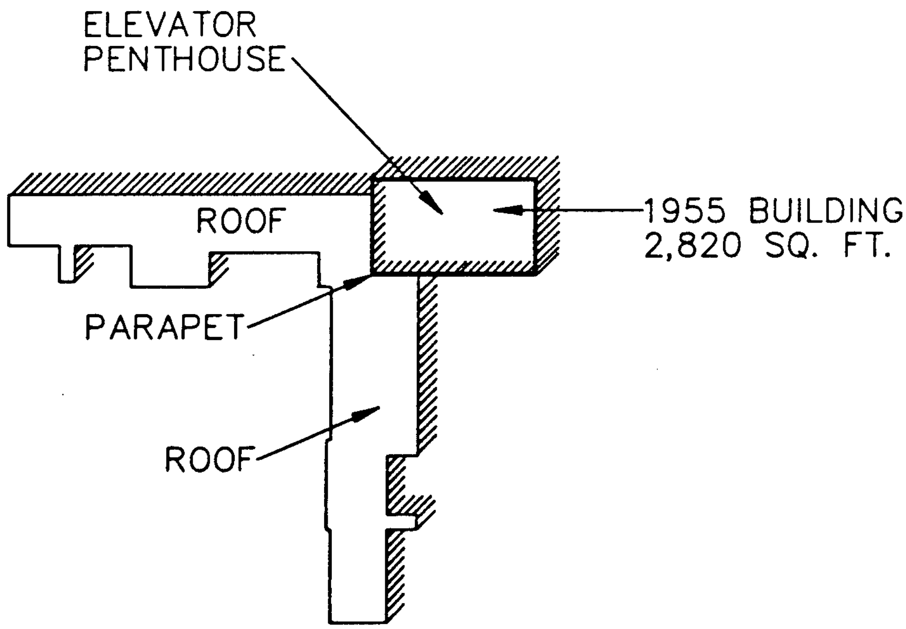


EXHIBIT NO. 12 – BUILDING 600



SEVENTH FLOOR PLAN

SCALE : 1"= 80'-0"

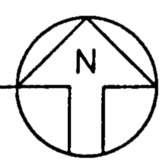


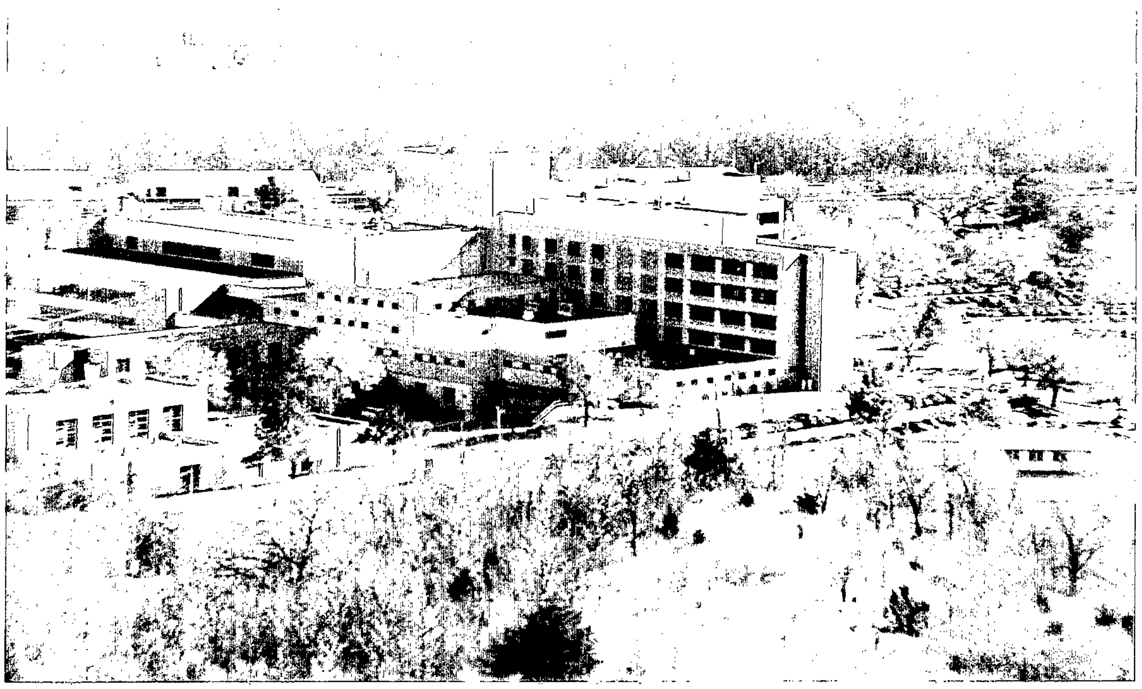
EXHIBIT NO. 13 — BUILDING 600

integral blinds or baked enamel aluminum faced insulated panels. Photograph Nos. 1 and 2 are aerial photos showing the south, west and north exposures of the 1955 hospital building respectively. Face brick back-up material is concrete masonry. Depending on building exterior wall locations, the masonry is further backed by rigid insulation, varying depths of air space, metal studs with plaster or gypsum board, or plaster on block in-fill where convector unit removal created voids in the wall.

Five elevators and eight stair towers provide vertical transportation to the multi-story hospital structure, including three stair towers provided as part of the 1975 project. A partial basement and five upper floors are served by the elevators. Mechanical equipment penthouses constructed as part of the 1985 Mechanical/Electrical Systems Upgrade Program are located on several roof areas of the 1955 building.

The 1975 addition is a basement plus three (3) story poured-in-place reinforced concrete structure with an exterior facade consisting of face brick, precast concrete panels, and insulated glass windows in thermally broken aluminum frames. Face brick is backed-up by poured-in-place concrete or concrete masonry units. Where finished interior spaces occur, gypsum

PHOTOGRAPH NO. 1 - 1955 BUILDING SOUTH AND WEST ELEVATION



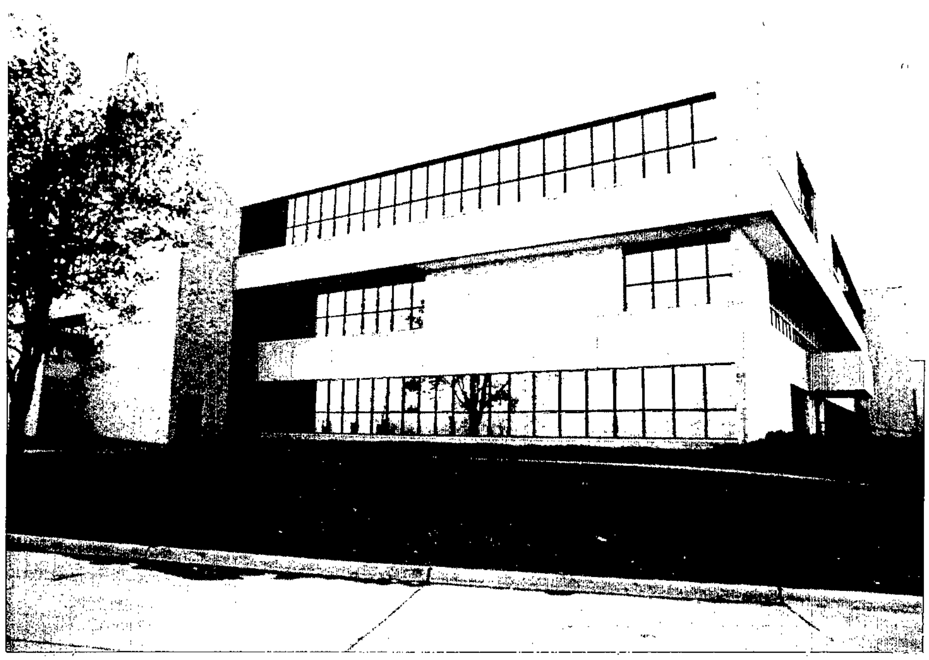
PHOTOGRAPH NO. 2 - 1955 BUILDING WEST AND NORTH ELEVATION

board on metal furring channels or metal studs are installed over the inside face of the masonry and/or precast panels. Precast concrete spandrel panels contain rigid insulation applied to their interior face. Soffit areas, especially at the service dock, are stucco on suspended metal framing. Photograph Nos. 3 and 4 show the partial north and east elevations of the 1975 addition.

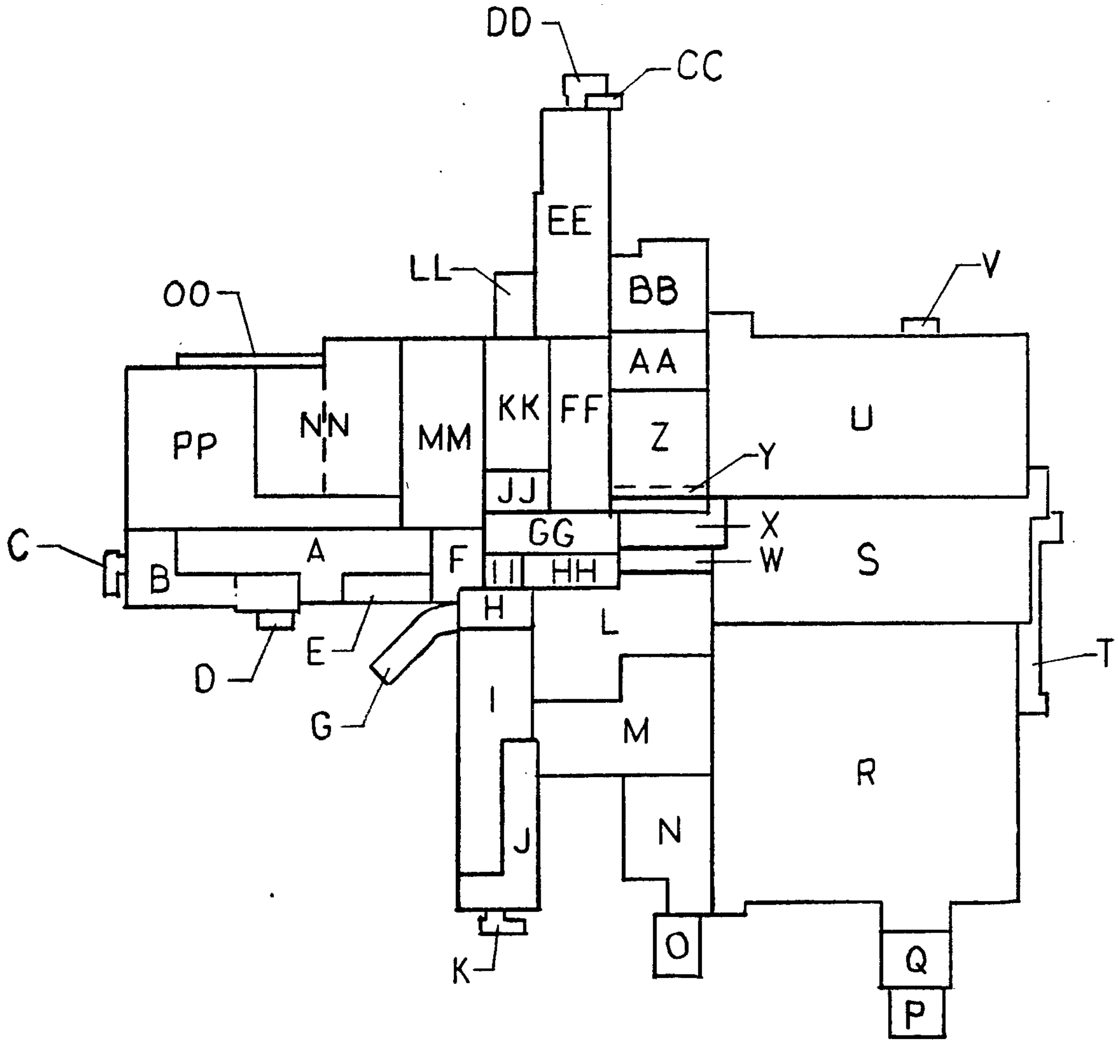
Roof areas of the 1975 addition are either tar and gravel built-up roofing over rigid insulation on concrete deck or a ballasted EPDM roof system over rigid insulation on concrete deck. Poured gypsum fill occurs as required to achieve positive drainage to roof drains and interior drain lines. The tar and gravel roofing system is being replaced by a ballasted EPDM roof system as part of an on-going roof replacement program where designated in Exhibit 14 herein. 1955 Building main entry canopy and "B" Wing entry canopy roof areas are also being re-roofed as part of this same roof replacement program.

Two elevators and two stair towers provide vertical transportation within the basement, and two story 1975 addition. Elevators provide entrance to a third floor penthouse, as does one stair tower and a third stair between first floor and penthouse. A horizontal

PHOTOGRAPH NO. 3 - 1975 ADDITION PARTIAL NORTH ELEVATION



PHOTOGRAPH NO. 4 - 1975 ADDITION PARTIAL EAST ELEVATION



BUILDING ROOF PLAN

SCALE : 1"= 100'-0"

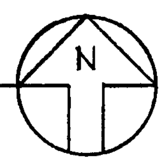


EXHIBIT NO. 14 – ROOF AREAS, BUILDING 600

corridor connects the third floor penthouse with the third floor of the 1955 hospital building.

The original hospital building constructed in 1955, and upgraded in the 1985 mechanical/electrical repair project, is served by eleven (11) separate air handling units.

Generally the new air handling units include - roof mounted outside air intakes; integral face and bypass steam heating coils; return/outside mixing plenum, air blenders to avoid stratification; primary air filters, chilled water cooling coils, hot water heating coils, intermediate filters, steam grid humidifiers; air silencers; supply air fans (dual fans for units A6-1, A6-2, C4-1 and C4-2); relief air fans; air flow monitoring stations; dampers for full economizer cycle capability and variable pitch blades on fans for variable air volume capability. Each penthouse contains a steam to hot water heat exchanger, hot water pumps, compression tank and accessories. The sixth floor penthouses contain a steam to steam heat exchanger for area humidification requirements.

Air distribution for these air handlers consist of high velocity and low velocity ductwork, constant volume/variable air volume boxes, supply diffusers/

registers, return grilles, exhaust registers and final filters for the critical areas. In general the exhaust duct risers are connected to roof mounted or penthouse located exhaust fans.

The 1975 Addition and selected adjoining areas of the Original Hospital are served by 8 separate air handling units. All of these units are located in the third floor mechanical room and are connected by sheet metal ductwork, in some cases very long runs, to the specific areas served. All units are constant volume variable temperature type air handlers. Air handlers designated S-1 through S-7 are equipped with terminal hot water reheat coils either per individual room or groups of rooms served. Air handling unit S-8 serves only the third floor mechanical room.

Air distribution from these units consists of low and medium pressure rectangular sheet metal ductwork, supply diffusers, supply registers, return/exhaust registers and duct mounted reheat coils. Most of the rooms have ceiling outlets for supply and return air flow. Several vertical duct shafts, connected to the third floor mechanical room, distribute and collect air on the individual floors. The strategic location of these duct shafts does not eliminate some extremely long duct runs.

All air handling unit designations are alpha numeric with a letter prefix and number suffix. Prefixes beginning with the letters "A", "B", and "C" are units installed in 1985 and serve areas mainly in the 1955 hospital building. The prefixes indicate the hospital wing the air handler is located in and serves. Air handling units beginning with the letter "S" were installed during the 1975 hospital addition construction. Table No. 1 identifies all air handling unit designations, unit types, unit capacity and the general hospital area served.

Controls for all of the air handling systems are a combination of pneumatic and electronic devices. The entire hospital has a new Energy Management System which is currently being installed to interface with the local pneumatic loop controls. The system architecture is such that the Energy Management System can start/stop units, reset temperatures and monitor operating conditions. The EMS will fail to the local pneumatic loop controls.

Domestic hot water for the entire hospital building is provided by four vertical steam fired, storage water heaters installed in 1985. The water heaters are located in the 1955 building basement mechanical room adjacent to the hospital kitchen.

TABLE NO. 1

HOSPITAL AIR HANDLING UNITS

UNIT DESIGNATION	UNIT TYPE	UNIT CAPACITY CFM	AREA SERVED
A6-1	DDVAV	25400	Basement General 1st Flr. Admin.
A6-2	DDVAV	22500	"A" Wing Patient Area
B2-1	DDVAV	27300	1st Flr. Outpatient Clinic "B" Wing
B2-2	DDVAV	16140	Kitchen and Dining
B2-3	SZ	23330	Kitchen Make-up
B6-1	DDVAV	20000	"B" Wing Patient Area
B6-2	DDCV	11500	Dental Surgery Clinic ICU, Mobil OR
CB-1	DDVAV	7000	1st Floor "C" Wing Offices
C4-1	DDCV	12150	2nd Floor OR
C4-2	DDCV	9500	3rd Flr. Labor & Delivery
S-1	TRH	33890	Basement Clinic, 1st Flr. Clinic, 2nd Flr. Admin.
S-2	TRH	24390	Emergency and Walk-in Clinic
S-3	TRH	33760	Pharmacy, X-Ray, Audio Visual Clinic
S-4	TRH	34295	Central Steril, O.T., P.T., Allergy, Psychiatric

TABLE NO. 1 (cont'd)

UNIT DESIGNATION	UNIT TYPE	UNIT CAPACITY CFM	AREA SERVED
S-5	TRH	33720	Lab, Dermatology Chapel
S6-1	SZ	812	Emergency Trauma
S-7	TRH	19000	Bulk Storage Snack Bar
P7-1	SZ	6000	Elevator Penthouse
S-8	SZ	10000	Third Floor Mechanical Room

Transformers and electric distribution equipment within the 1955 Hospital building were replaced as part of the mechanical/electrical upgrade project in 1985. The electrical distribution system throughout the entire hospital is 277/480 volt system with dry type transformers serving the 120/208 volt panels. Emergency power for the hospital is supplied from three (3) diesel engine driven generators located in the basement of the 1975 addition.

Lighting throughout the entire hospital is generally 277 volt, ceiling mounted, 1 x 4 or 2 x 4 fluorescent type fixtures supplemented with incandescent task or accent lighting.

Facility conditions observed based on site observations and inspections by representatives of The Design Team.

1. The 1975 Building exterior windows are glazed with tape on the inside face and a vinyl bead on the exterior face. Glazing is tight in most areas with one exception being the south windows of the first floor laboratory where a portion of the vinyl bead at the head jamb is loose and draped downward. It appears that remedial work has occurred on most 1975 windows. Sealant has been added at exterior joints

between aluminum sill and jamb frames and "drain" holes have been drilled in the vertical face of the sill frame approximately six inches from each corner.

2. The south half of the roof area over the laboratory is the original tar and gravel built-up roofing (area "M" of Exhibit 14); this roof needs maintenance and repair.

3. Repair or replace the expansion joint cover between the Emergency Department canopy and Ambulance Garage, and between Emergency Department canopy and Emergency Department. The cover has missing sections such that birds gain access to the expansion joint and build nests therein.

4. The brick shelf angle on the east face of "A" Wing (third floor level, 1955 building) needs to be reviewed and possibly re-caulked. The concrete face on the east side of "A" and "C" wing is also stained.

5. Former Library (room 2G5) window head jamb gasket is sagging downward and needs to be reinstalled or replaced.

6. The single pane roof skylight glazing at the north stair tower of the 1975 addition is broken and needs to be replaced.

7. The 1955 building brick to concrete column and horizontal spandrel beam joint sealant has hardened and pulled free from adjacent surfaces. Joint sealant restoration work is needed.

8. Cast stone sills of 1955 hospital window units contain numerous weather cracks and will experience rapid deterioration as winter/summer freeze/thaw cycles continue. The joint between this sill member and face brick below is pushed outward at several locations. Joint restoration and cast stone sill replacement is recommended on all elevations of the 1955 building.

9. Existing windows (frames and glazing) observed in several locations, while weather tight are not energy efficient and therefore should be replaced with energy efficient units in the following areas:

   a. Existing windows in the second floor corridor between 1955 and 1975 Buildings are single pane glass in steel framed double hung, fixed sash, three openings each approximately 6'-3" high x

12'-0" long, should be replaced with insulated glass and panels set in aluminum frames and sash containing thermal breaks.

b. Second floor chapel windows located in the 1955 Building are single glazed, double hung, fixed units in steel sash and frames which should be replaced with energy efficient units. Existing window unit sizes are 6'-6" high x 8'-0" long and 12'-0" long each.

c. Basement level north wall Dining Room windows are 3/16" clear glass units set in fixed steel frames. Window areas approximate 8'-9" high x 19'-6" long. These units should be replaced with one inch tinted, insulated glass set in aluminum frames with integral thermal breaks.

d. Bakery windows located in the north wall adjacent to the Dining Room on the basement level of the 1955 Building are 1/4" clear glass in painted steel frames. Window size approximates 3'-6" high x 16'-0" long. These windows should be replaced with tinted insulated glass set in frames with integral thermal breaks.

10. The existing food service entrance consists of a pair of 3'-0" wide x 7'-0" high steel doors with plexiglass vision panels and a 2'-0" high x 6'-0" wide glass transom above. This complete assembly should be replaced with a more energy efficient assembly containing proper closures and weatherstripping.

11. The north overhead door located in the 1975 Addition at the east service dock is damaged and needs to be repaired.

12. There are limited low areas on grade at exit stair stoops that have settled which should be filled and raised.

13. Entry vestibule and enclosures were observed and determined to be inadequate in the following areas:

    a. First floor 1955 Building main hospital entrance vestibule.
    b. Basement level 1975 Building family practice clinic entry.
    c. Basement level 1975 Building east service dock.
    d. Basement level 1955 Building north dietary service dock.

Entry vestibules/door assemblies observed and determined to be adequate include:

a. Basement level stair tower exterior exit doors: Thresholds and weather stripping was observed and determined to be in good condition, however; stair "B" exit door was ajar due to a wood block being placed atop the threshold at the strike jamb.

b. Basement level "C" wing east entry near the PBX and snack shop: Interior double doors were replaced during this survey and analysis. The aluminum frame/glass vestibule, while not insulated glass or panels in aluminum frames with thermal breaks, is adequate because of the new interior doors and because the entire vestibule is an appendage to rather than part of the building proper.

c. 1975 Building first floor general outpatient clinic entry contain automatic doors in a recessed entry vestibule set in 6'-6" from the face of the building. Vestibule doors are 12'-0" apart.

d. 1975 Building first floor emergency department entry: Automatic doors set 12'-0"apart and controlled by recessed floor mats.

14. Precast concrete panels on the north elevation of the 1975 Addition are beginning to deteriorate at panel joints near the lower panel edge. This condition was observed at two locations.

15. Generally, the HVAC equipment appeared to be in good condition and well maintained. Filters and coils on all units inspected were clean. Air handling units and casings in the 1975 addition are showing signs of wear and deterioration from age. Return/relief fan RE-1 was experiencing excessive vibration due to an apparent bent drive shaft.

16. Numerous complaints were recorded from building occupants with regard to temperature conditions in areas of the 1975 addition.

17. Generally, all motors 3/4 hp and larger are high efficiency 480 volt, three phase. All motors 1/2 hp and smaller are high efficiency 120 volt, single phase.

18. Main kitchen hood exhaust fan is operated continuously during kitchen occupation.

19. Domestic hot water for the entire hospital is heated and maintained at 135 degrees F.

20. Lighting levels recorded during the survey were generally at or slightly above levels required by current criteria. It was observed that numerous lights were energized in office areas, lounges and breakrooms even though not occupied 100 percent of the time.

21. Water hammer was observed in fourth floor penthouse at steam-fired unit heaters.

Based on site observations and review of drawings for this building and discussions with hospital operating personnel, the following are ECO's recommended for analysis for this building:

1. Replace existing tar and gravel built-up roofing in designated areas "M, U, W, Z, and A-A" (Exhibit 14) with 2-1/4" rigid insulation and ballasted E.P.D.M. roofing to match existing adjacent areas.

2. Replace with one inch reflective insulating glass, ("U" valves of .57 and shading coefficient of .40) and aluminum frames with integral thermal breaks at the following locations:

   a. Second floor corridor connecting 1955 and 1975 Building additions.
   b. Second floor chapel windows.
   c. Basement floor dining room windows.
   d. Basement floor bakery windows.

3. Modify and/or provide entry vestibules at the following locations:

   a. First floor 1955 Building main hospital entrance.
   b. Basement floor 1975 Building family practice clinic entry.
   c. Basement floor 1975 Building east service dock.
   d. Basement floor 1955 Building north dietary service dock.

4. Provide heat recovery systems on the kitchen exhaust system and surgical suite air handling units due to the large amount of outside air required to make-up for exhaust air.

5. Modify/provide controls for de-energization of kitchen hood exhaust system when not required for cooling purposes.

6. Modify/provide restrictive shower flow heads and automatic faucets in public toilet facilities.

7. Modify/provide alternate domestic water heaters and reset hot water temperature.

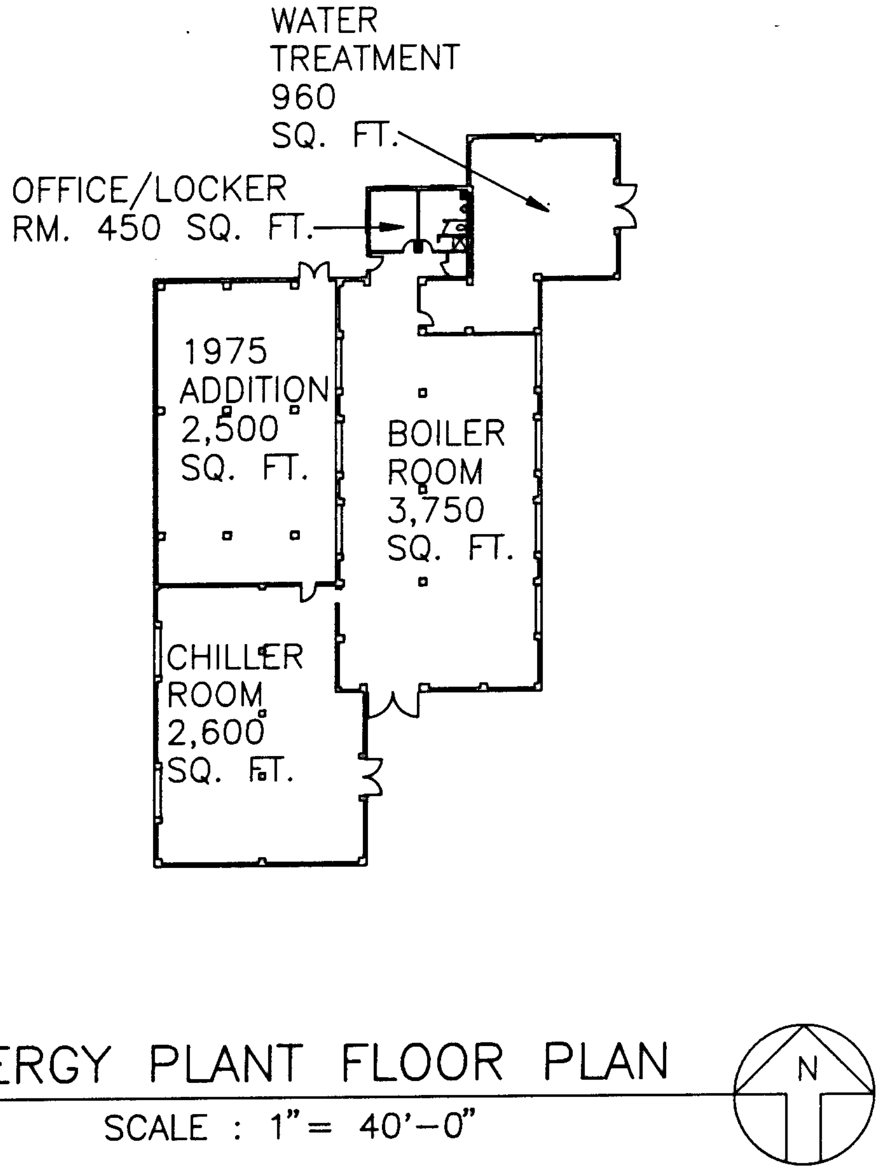
8. Modify lighting, lighting switching and/or switching controls.

B. BUILDING NO. 615 - ENERGY PLANT:

The Energy Plant Building was constructed at the same time as the original hospital (1954-1955) to serve the hospital building and three other buildings. The energy plant is a separate structure located approximately 250 feet north of the hospital building and connected to the hospital by an underground utility tunnel. Distance to the other buildings is approximately 250 feet to Building 610 and 800 feet to Buildings 620 and 621.

The original Energy Plant Building is approximately 7800 total square feet. The building is comprised of the chiller room, boiler room, water treatment room, and office/locker rooms. In 1975, the Energy Plant was expanded northward to house new chillers installed with the 1975 hospital building addition. This expansion added approximately 2500 square feet of additional floor space. The Energy Plant floor plan is illustrated in Exhibit No. 15.

Building construction is a single story poured-in-place reinforced concrete structure with single ply roofing on rigid insulation on concrete pan and joist system. Floor to floor heights are 14'-0" in the chiller and water treatment rooms to 30'-0" in the boiler room.



ENERGY PLANT FLOOR PLAN

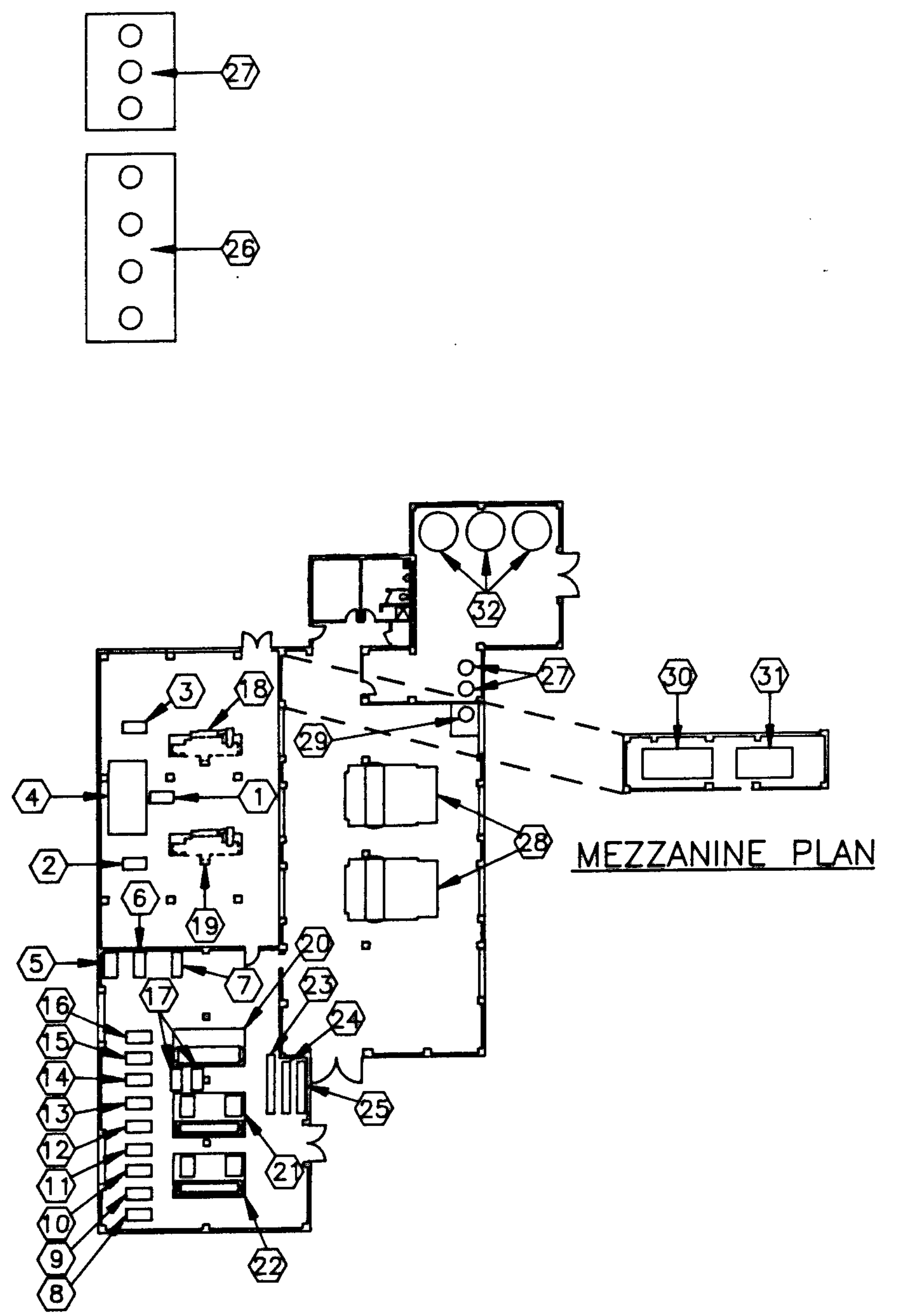
SCALE : 1"= 40'-0"

EXHIBIT NO. 15 – ENERGY PLANT, BUILDING 615

Exterior windows are single pane clear glass with steel frames. Located at the north end of the boiler room is a mezzanine floor which houses boiler equipment accessories. A small metal building addition is attached to the south end of the boiler house. New emergency generators are scheduled to be installed in this area.

The Energy Plant Building houses boilers, auxiliaries, chillers, water softeners, and office/locker rooms as illustrated in Exhibit No. 16 and Table No. 2. Cooling tower cells are located exterior to the building at grade level north of the Energy Plant Building. Steam and condensate lines have been extended in underground conduit systems to nearby Buildings 610 on the east and 620 and 621 on the west.

1. <u>Heating Plant</u>: The heating plant consists of steam boilers, deaerating heater, surge tank, boiler feed pumps, transfer pumps, blowdown tank, fuel oil storage tanks, fuel oil pumps, natural gas supply, chemical feed system, and connecting piping. The two boilers are Babcock Wilcox steam boilers, Contract No. FF2527, each rated at 34,000 lbs. per hour. Boilers are designed for 200 PSIG steam working pressure and are operated at 125 PSIG. The boilers are operated on dual fuels; natural gas and



ENERGY PLANT FLOOR PLAN

SCALE : 1"= 40'-0"

EXHIBIT NO. 16 – EQUIPMENT LOCATION

TABLE NO. 2

ENERGY PLANT EQUIPMENT LIST

1 CONDENSER WATER PUMP

2 CONDENSER WATER PUMP

3 CONDENSER WATER PUMP

4 REMOTE COOLING TOWER BASIN

5 CONDENSER WATER PUMP

6 CONDENSER WATER PUMP

7 CONDENSER WATER PUMP

8 CHILLED WATER PRODUCTION PUMP

9 CHILLED WATER PRODUCTION PUMP

10 CHILLED WATER PRODUCTION PUMP

11 CHILLED WATER PRODUCTION PUMP

12 CHILLED WATER PRODUCTION PUMP

13 CHILLED WATER PRODUCTION PUMP

14 CHILLED WATER DISTRIBUTION PUMP

15 CHILLED WATER DISTRIBUTION PUMP

16 CHILLED WATER DISTRIBUTION PUMP

17 EXPANSION TANKS

18 ELECTRIC DRIVEN CENTRIFUGAL CHILLER

19 ELECTRIC DRIVEN CENTRIFUGAL CHILLER

20 STEAM DRIVEN CENTRIFUGAL CHILLER

21 STEAM DRIVEN CENTRIFUGAL CHILLER

22 STEAM DRIVEN CENTRIFUGAL CHILLER

TABLE NO. 2 (cont'd)

23	CONDENSER FOR STEAM DRIVEN CHILLER
24	CONDENSER FOR STEAM DRIVEN CHILLER
25	CONDENSER FOR STEAM DRIVEN CHILLER
26	4-CELL COOLING TOWER
27	3-CELL COOLING TOWER
28	BOILER
29	BOILER BLOWDOWN TANK
30	DEAERATOR/BOILER FEED PUMPS
31	SURGE TANK/TRANSFER PUMPS
32	WATER SOFTNER TANKS

No. 2 oil, and have both forced draft and induced draft fans with stub stacks.

2. Cooling Plant: The cooling plant consists of water chillers, cooling towers, expansion tanks, condenser water pumps, chilled water pumps with primary/ secondary chilled water distribution system and connecting piping.

Two identical centrifugal chillers manufactured by Carrier Corporation were installed when the original hospital was constructed. Each chiller is rated at 200 tons providing chilled water at 41 degrees F. discharge water temperature. Chillers are driven by steam turbines designed for 125 PSIG inlet pressure and 4 inch Hg absolute exhaust pressure. A steam turbine driven York centrifugal chiller rated at 200 tons was added in 1969. The York chiller provides chilled water at 45 degrees F. discharge water temperature

Two identical Trane Centravac electric driven centrifugal chillers were installed when the hospital addition was constructed in 1975-1977. These chillers are driven by 480 volt, three phase, 3,600 rpm motors rated 562 amperes. Each chiller is

rated at 475 tons providing chilled water at 42 degrees F. leaving water temperature.

3. <u>Water Softeners</u>: All water used in the Energy Plant and Hospital building is supplied from zeolite water softeners of Monarch and Bruner manufacturers located in the Energy Plant.

Facility conditions observed based on site observations and inspections by representatives of the Design Team are as follows:

1. All existing energy plant equipment is reported to be in good condition and has no visible defects. The boilers, draft fans, steam driven centrifugal chillers and condensers, although aged, have been well maintained and repaired regularly.

2. Chillers and staging of chillers are manually controlled by Energy Plant operators based on weather, operating history, and communication with hospital personnel.

3. All pumps for chilled water and condenser water systems are constant volume.

4. Heat recovery is not being utilized on any of the Energy Plant systems.

5. Concrete wall panel joint sealant appears to be original and should be scheduled for replacement as a maintenance and repair item.

6. General condition of Energy Plant facility was extremely clean. All equipment and piping systems were clearly labeled or color painted.

Based on site observations and review of drawings for this building and discussions with Energy Plant operating personnel, the following ECO's are recommended for analysis for the Energy Plant systems:

1. Evaluation of the required maximum boiler steam pressure.

2. Modify/addition to existing chiller controls and operation of chillers.

3. Replacement of existing steam driven centrifugal chillers with more efficient equipment and configuration for equipment staging.

4. Provide variable speed pumping for the chilled water system distribution pumps.

5. Provide one small off-peak boiler to satisfy the steam requirements of the hospital complex.

6. Modify/addition to existing boiler controls and operation of boilers to improve system efficiency.

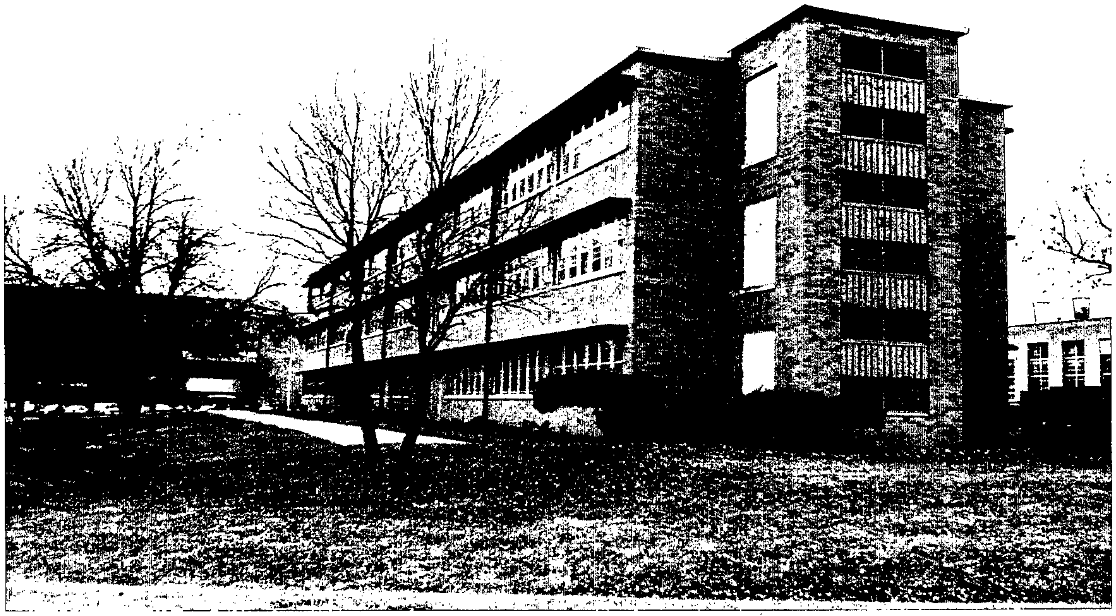
7. Provide heat recovery for boiler systems and condensing water system.

C. BUILDING NO. 610 - NURSES QUARTERS

The Nurses Quarters Building was constructed in 1957 on relatively flat property located northeast of the hospital building. Walking distance between the hospital and Nurses Quarters is approximately 750 feet.

The building is 212'-0" long by 39'-0" wide with 12'-8" wide by 14'-8" long mechanical equipment rooms at the north and south ends. Two entry points are located on the east side and one entry is located on the west. An interior stairwell is located adjacent to each east entry.

Building construction is a three (3) story reinforced concrete frame with brick and block exterior walls, and painted block interior walls. Floor to floor heights are 10'-8" each. Exterior windows are aluminum double hung with interior mounted storm windows. The interior storm windows are recently installed (2 to 3 years age). Observations note the caulking and sealant to be in good condition. Most windows are in groups of six (6) creating a horizontal window band on each level of the east and west elevations. Also on the east and west elevations at the window head is a continuous concrete sun screen overhang projecting 2'-8" from the face brick. Photograph No. 5 shows the north and east



PHOTOGRAPH NO. 5 - BUILDING 610 NORTH AND EAST ELEVATIONS

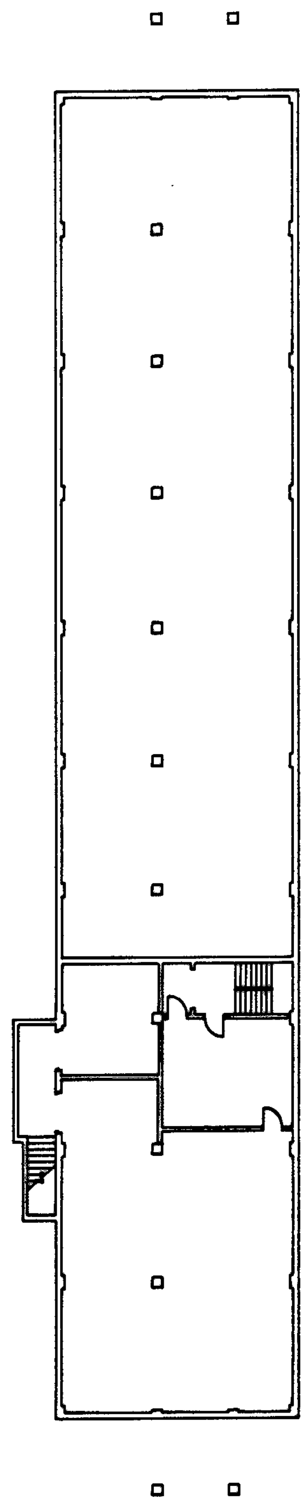
PHOTOGRAPH NO. 6 - BUILDING 610 SOUTH AND WEST ELEVATIONS

elevation and Photograph No. 6 shows the south and west elevation. Both photos indicate the horizontal window band and concrete sun screen overhang.

Exhibit Nos. 17, 18, 19, and 20 illustrate the basic floor plan layout and arrangement of the Nurses Quarters Building.

A central corridor is located on each level with a suspended acoustical tile ceiling system. Ceiling height is 7'-2". Supply air ducts are located in the corridor ceiling void. The ducts extend from supply registers in each room/corridor wall to the mechanical equipment rooms located on each level. Asbestos is suspected in the equipment room pipe insulation.

Interior finishes generally include vinyl asbestos flooring with glazed tile base in all areas except bathing and shower areas which are ceramic tile including wall wainscot. Other walls are painted. Ceilings in rooms vary from suspended acoustical ceiling tiles to painted concrete. Door assemblies are 3'-0" wide x 7'-0" high solid core wood and hollow metal frames. Corridors of each floor contain ceiling mounted smoke detectors and surface mounted fluorescent wall light fixtures located near the ceiling line adjacent to room door assemblies.



BASEMENT FLOOR PLAN

SCALE : 1"= 30'-0"

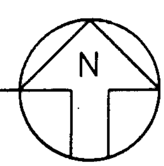
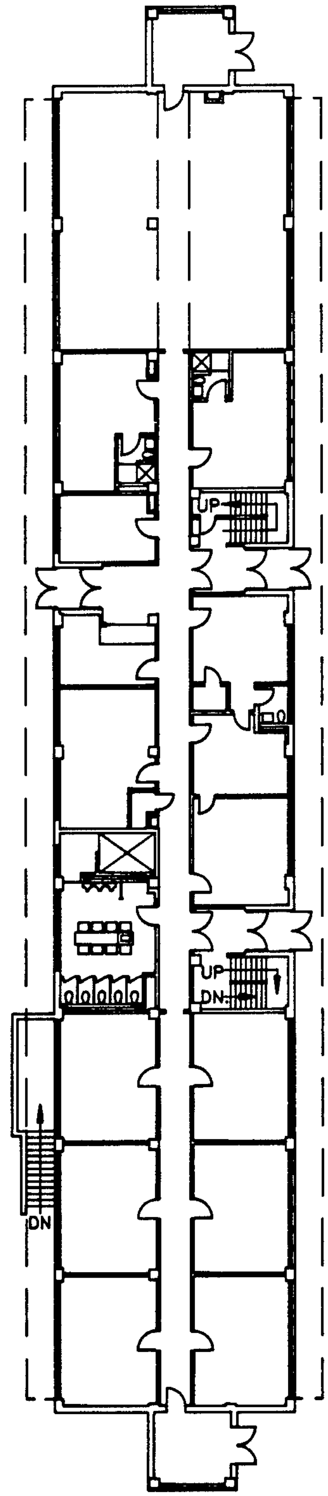


EXHIBIT NO.17 – BUILDING 610



FIRST FLOOR PLAN

SCALE : 1"= 30'-0"

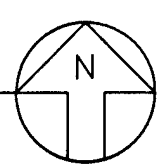
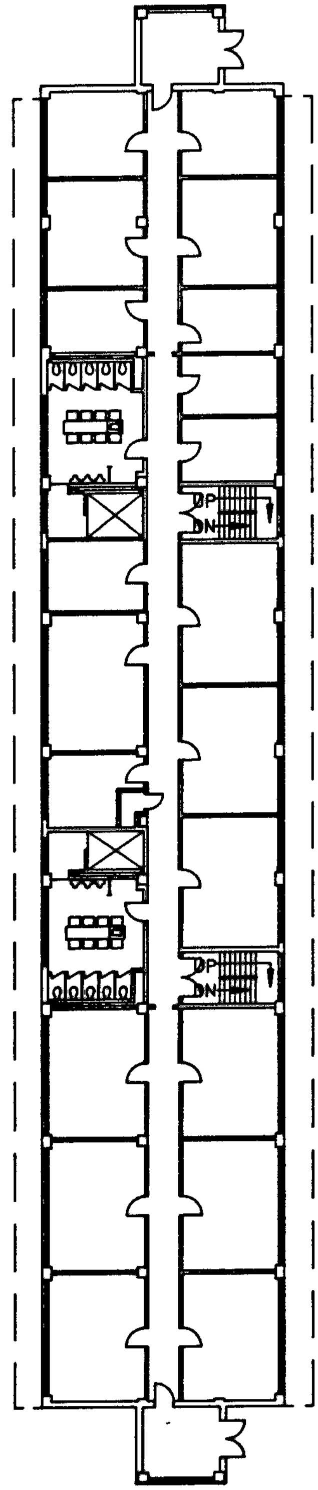


EXHIBIT NO. 18 — BUILDING 610



SECOND FLOOR PLAN

SCALE : 1"= 30'-0"

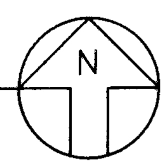
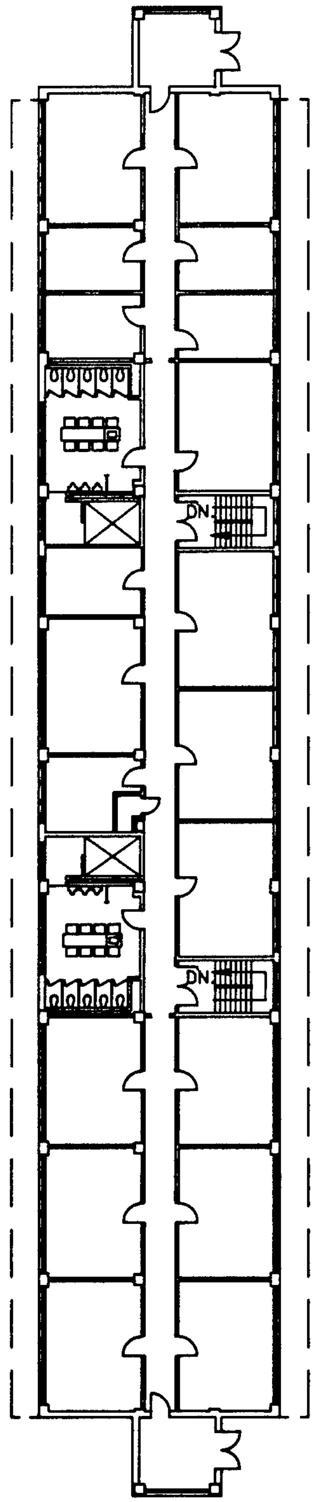


EXHIBIT NO. 19 — BUILDING 610



THIRD FLOOR PLAN

SCALE : 1"= 30'-0"

EXHIBIT NO. 20 – BUILDING 610

Approximate building square foot area is calculated to be:

Partial Basement	2,886 sq. ft.
First Floor	8,640 sq. ft.
Second Floor	8,640 sq. ft.
Third Floor	8,640 sq. ft.
	28,806 total sq. ft.

Access to the basement is via the south interior stair and an exterior stairwell located on the west side of the building. Basement areas include a large meeting room, storage lockers, and a mechanical equipment room. Asbestos is suspected in equipment room pipe and equipment insulation.

A large day room, control and information office, several general offices, and supply office/storage suite are located on the first floor as well as toilet and bathing facilities, living/sleeping quarters for the Officer in Charge, transients, and temporary duty personnel. Living and sleeping quarters including toilet, bathing and laundry facilities are located on each of the upper two floors along with the previously mentioned HVAC equipment rooms. Room lighting is

generally provided by surface mounted fluorescent ceiling fixtures.

Roof construction is built-up tar and gravel on roofing felts on lightweight concrete three inches (3") deep at the ridge line and pitched to drain (1/8" per 1'-0") to a continuous perimeter gutter and downspout drainage system. Roofing appears dated, but in good condition. Gutters and downspouts need minor remedial work, especially where gutters terminate at on-grade splash blocks.

Stairwell doors from the corridor on each level are self-closing, but are not positive latched. Travel distance from second and third floor south rooms (Room 302 measured) to the nearest stairwell is 55'-0". Living/sleeping room doors are self-closing and positive latched. Corridors are 5'-0" wide. Floor areas are not smoke or fire compartmentalized. A drinking fountain is located on each level near and in each toilet/bathing facility.

End walls (north and south) of each HVAC room are constructed of painted metal panels (5 each) and painted louvers (6 each). Louvers and panels need painting.

The northwest corner of the building contains a vertical crack in the brick extending from the roof gutter downward to grade. The crack appears to be stress related rather than caused by building settlement. The other three corners of this building also have similar conditions, but not as severe as the northwest corner. Recommended remedial work includes incorporation of a brick facade expansion joint and replacement of broken brick units at all corners of the building.

Replacement caulking is recommended for the horizontal brick shelf angle near the northeast corner of the building.

Further investigation as to the probable cause for apparent efflorescence observed on the east building facade near the center of the building is recommended.

Re-establishment of original entry vestibules is recommended for each of the three entry points.

Recommended work includes:

1. Replace four pair of painted metal doors with four pair of insulated metal doors including vision panels, weatherstripping, and thresholds (exterior doors only).

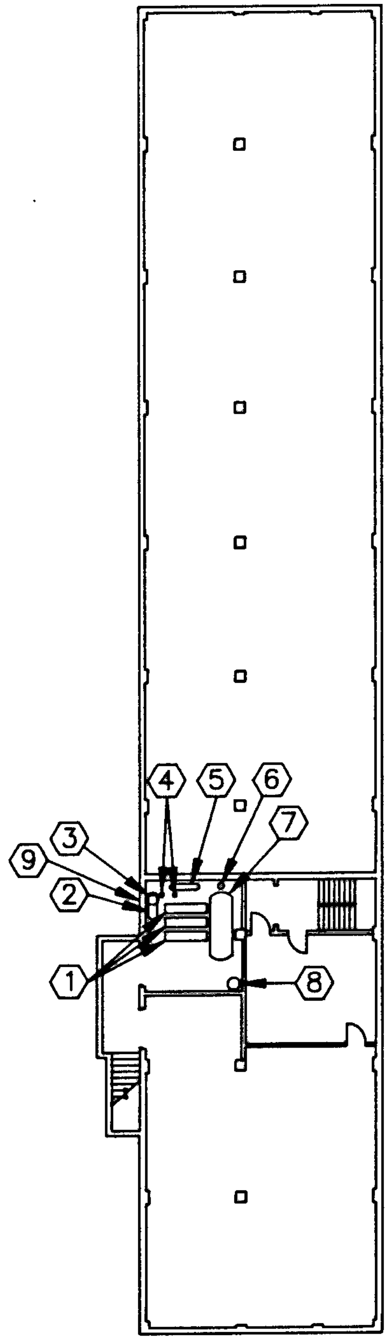
2. Replace one pair of screen doors and one pair of metal doors in existing hollow metal frames. The replacement and added hollow metal doors are proposed to be existing exterior assemblies removed, refinished and installed in these locations.

3. Doors are 3'-0" wide x 7'-0" high each.

Repair of the southwest leaking exterior water hydrant including sealant between the hydrant flange and brick face is recommended.

There are several low spots in the grade near the building which ponds rain water, and if not repaired, will cause deterioration of the foundation system due to water freeze/thaw cycles associated with weather systems in this region of the country. Conditions observed are not considered critical and can be easily addressed by scheduled on-going maintenance and repair projects.

The basement mechanical room, Exhibit No. 21 and Table No. 3, houses the steam heated, insulated storage tank and circulating pumps for domestic water use, the steam fired heat exchanger and circulating pumps for the building heating system. This equipment, installed in 1957 when the building was constructed, is inefficient by todays standards and has served its useful life.



BASEMENT MECHANICAL ROOM

SCALE : 1"= 30'-0"

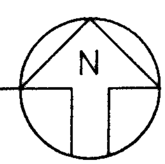


EXHIBIT NO. 21 — BUILDING 610

TABLE NO. 3

EQUIPMENT LIST BUILDING 610

DESIGNATION	DESCRIPTION	SERVICE	DATE INSTALLED
1	3-Expansion Tanks	Hot Water Heating	1957
2	Flash Tank	Steam/Condensate	1957
3	Condensate Pump	Condensate System	1957
4	2-Hot Water Circulating Pumps	Hot Water Heating	1957
5	Steam to Hot Water Converter	Hot Water Heating	1957
6	Hot Water Recirculating Pump	Domestic Hot Water System	1957
7	Steam-Fired Hot Water Generator	Domestic Hot Water System	1957
8	Bilge Pump	Sanitary Waste System	1957
9	Pressure Reducing Station	Steam System	1957

Heating for this building is provided by individual room baseboard hot water heating units.

The cooling only air handling units, located in equipment rooms at the ends of each floor, include filters, chilled water cooling coils and supply air fans. The air handling units are equipped with economizer cycles for utilization of outside air for cooling. Supply air is distributed to the rooms thru supply ductwork and returned utilizing the corridor ceiling void as a return air plenum. The air-cooled chiller for the chilled water system is located on grade at the northwest corner of the building.

Steam is piped from the Energy Plant to this building at 125 PSIG and reduced locally to 40 PSIG for heating purposes.

Based on site observations, review of existing plans for this building and discussions with operating personnel, the following are ECO's recommended:

1. Replace existing aluminum double hung windows and interior mounted aluminum storm windows with thermally broken aluminum windows containing one inch (1") bronze tinted insulating glass and insulated wall panels. The finish of exposed

aluminum and insulated panels shall be bronze. The total number of window units to be involved equal 339 of which 220 shall be window units and 119 shall be insulated panels.

2. Replace three (3) exterior and one (1) interior (west side) door assemblies with new insulated metal doors including thresholds (where applicable) and weatherstripping.

3. Replace existing steam-fired equipment with local gas-fired equipment utilizing high efficiency modular hot water boilers.

4. Replace existing plumbing fixture trim with flow restricting shower heads and automatic faucets.

5. Reset domestic hot water temperature.

D. BUILDING NOS. 620 AND 621 - FAMILY HOUSING BARRACKS

Buildings 620 and 621 are Family Housing Barracks located on flat property west of the existing hospital. These buildings are also referenced as Barnes & Kimball Hall respectively. Each building contains a partial basement and two floors as illustrated by Exhibit Nos. 22, 23, 24, 25, 26, and 27. Building 620 is 220'-6" long by 25'-9" wide, and Building 621 is 183'-9" long by 25'-9" wide. Approximate floor areas are:

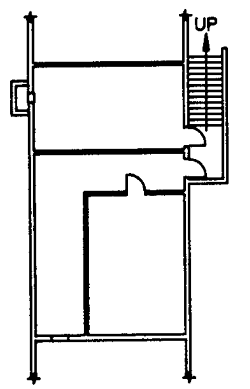
A. Building 620:

Partial Basement	1,159 sq. ft.
First Floor	5,678 sq. ft.
Second Floor	5,678 sq. ft.
	12,515 total sq. ft.

B. Building 621:

Partial Basement	1,159 sq. ft.
First Floor	4,732 sq. ft.
Second Floor	4,732 sq. ft.
	10,623 total sq. ft.

Building construction is wood framed except for the partial basement which is poured in place reinforced concrete. The first floor is approximately 2'-4" above



BASEMENT FLOOR PLAN

SCALE : 1"= 30'-0"

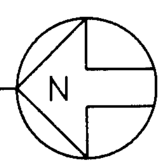
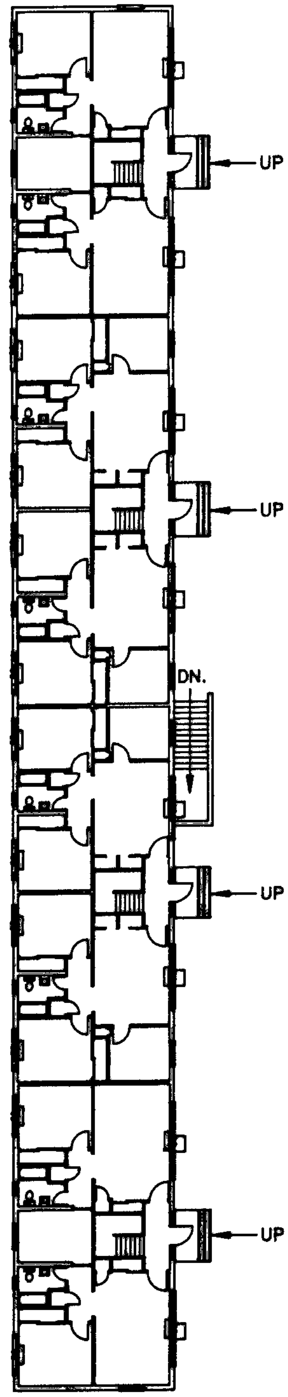


EXHIBIT NO. 22 – BUILDING 620



FIRST FLOOR PLAN

SCALE : 1"= 30'-0"

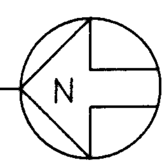
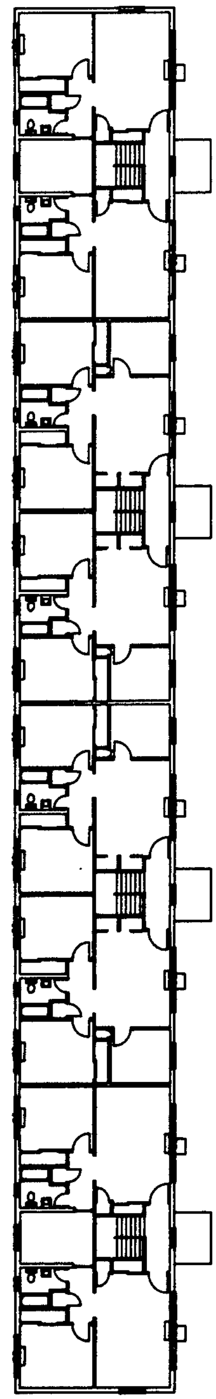


EXHIBIT NO. 23 — BUILDING 620



SECOND FLOOR PLAN

SCALE : 1"= 30'-0"

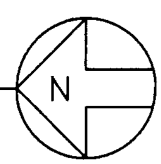
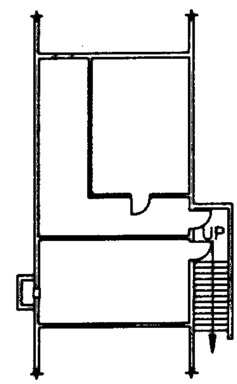


EXHIBIT NO. 24 – BUILDING 620



BASEMENT FLOOR PLAN

SCALE : 1"= 30'–0"

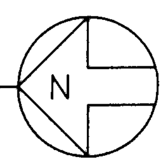
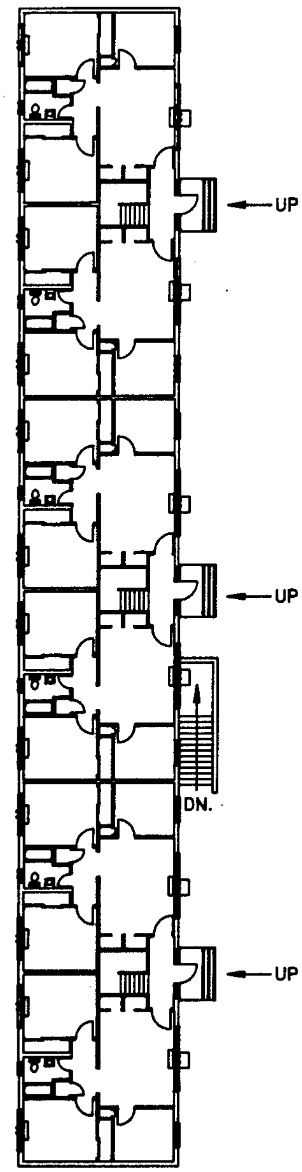


EXHIBIT NO. 25 – BUILDING 621



FIRST FLOOR PLAN

SCALE : 1"= 30'-0"

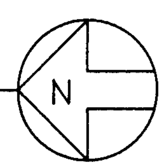
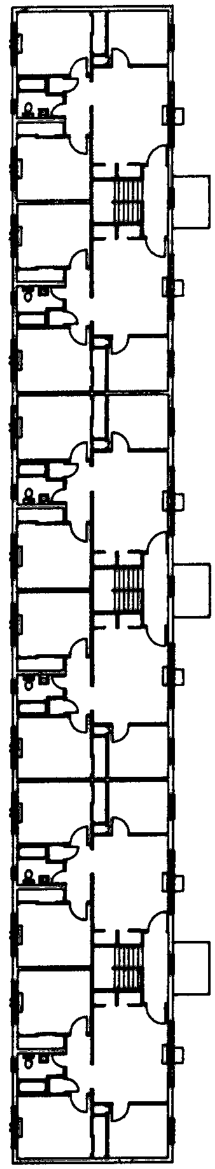


EXHIBIT NO. 26 – BUILDING 621



SECOND FLOOR PLAN

SCALE : 1"= 30'-0"

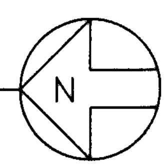


EXHIBIT NO. 27 – BUILDING 621

finish grade. A 2'-8" high crawl space below is present throughout, except where the partial basement occurs.

Access to the first floor from grade is via three concrete steps, concrete stoop, and step at entry door. Four entry points occur on Building 620 serving 16 quarters (8 units per floor). Second floor living quarters are reached via an internal stairway at each entry. Building 621 is similar to Building 620 except that there are three entrys serving two units each on two floors for a total of 12 family living quarters. Access to the partial basement of each building is via an exterior stairwell located on the south side of each building. Floor to floor height is 8'-11-1/2" per building.

Basement areas contain laundry and storage facilities, hot water heaters, and other mechanical equipment. Asbestos is suspected in the insulation of equipment and piping in these areas.

Exterior wall construction includes 2 x 4 wood studs, sheathing, four inch (4") face brick on the first floor and 3/4" vertical wood siding with 1" x 2" battens 8" o/c ± on the second floor. An approximate one inch (1") air space exists between brick and sheathing. The roof is a 4/12 pitch hipped roof with asphalt shingles

installed over building paper on 3/4" sheathing on 2 x 8 rafters 16" on center. A 2'-8" wide soffit occurs on each building with a continuous gutter. Downspouts to underground drain lines occur on north and south building elevations. Second floor exterior walls have three rows of horizontal blocking (per construction record drawings) to receive the vertical siding boards. Photograph Nos. 7 and 8 show the south, east and north exterior elevations of Building 620. Photograph Nos. 9 and 10 show the south, east and north exterior elevations of Building 621.

Based on the construction record drawings there is no insulation in the exterior walls. Also per review of the construction record drawings, attic insulation consists of 3-1/2" batt insulation between ceiling joists. The attic is vented via soffit vents.

Interior wall construction is one-half inch gypsum board on wood studs.

Existing windows are aluminum awning type windows with one-quarter inch single pane glass, and interior mounted double hung storm windows.

Entry hall exterior doors are hollow core wood with a glass sidelight on each side and a glass transom above.

PHOTOGRAPH NO. 7 - BUILDING 620 SOUTH AND EAST ELEVATION

PHOTOGRAPH NO. 8 - BUILDING 620 NORTH AND EAST ELEVATION

PHOTOGRAPH NO. 9 - BUILDING 621 SOUTH AND EAST ELEVATION

PHOTOGRAPH NO. 10 - BUILDING 621 NORTH ELEVATION

Frames are painted wood and glass is 1/4" clear plate. A 2'-6" diameter, fixed single pane glass window in painted wood frame is located on the second floor of the entry stairs.

At one location on the north face of Building 620 near the west end, the 2 x 8 soffit/vertical wall trim board is loose and should be renailed.

The sloped cast stone window sill mortar joint at many locations is deteriorated on each building. Tuckpointing is recommended.

Finish grade has settled on all sides of both buildings creating low spots and causing the entry sidewalks to break free from the concrete stoop/steps. Grade settlement is approximately four inches at entry stoops.

Incandescent exterior mounted security flood lights are mounted on each building.

Mortar joint deterioration was observed in limited areas along the north elevation of Building 621 specifically where the termite shield projects from the face of brick at the concrete foundation.

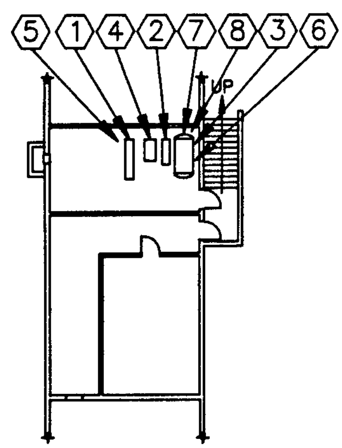
The basement mechanical rooms in each building house, as illustrated in Exhibit Nos. 28 and 29, the steam heated, insulated water storage tank and circulating pumps for domestic water use and the steam fired heat exchanger and circulating pumps for the building heating system. This equipment as listed in Table Nos. 4 and 5 is the same basic equipment installed when the buildings were constructed in 1959. It has served its useful life and is inefficient by today's standards.

Heating is provided by hot water fan coil units with one thru-wall fresh air vent per unit. The vent screens are painted over which greatly reduces the amount of fresh air to each unit. Water piping to second floor units is routed in continuous soffits above first floor windows.

Limited air conditioning is achieved by residential type window unit air conditioners located in the living room of each family housing unit.

Based on site observations, review of plans for each building and discussions among operating personnel, the following are ECO's recommended for these buildings:

1. Replace existing window air conditioning units with chilled water piped to existing fan coil units. Fan coil units to remain as two pipe units.



BASEMENT MECHANICAL ROOM

SCALE : 1"= 30'-0"

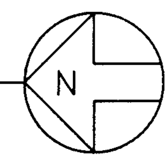
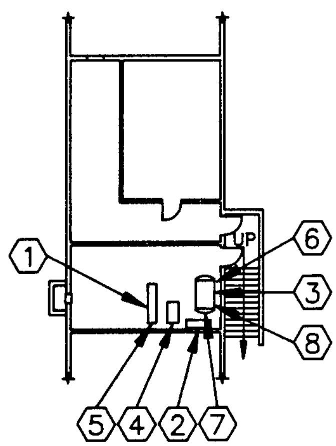


EXHIBIT NO. 28 – BUILDING 620

TABLE NO. 4

EQUIPMENT LIST BUILDING 620

DESIGNATION	DESCRIPTION	SERVICE	DATE INSTALLED
1	Expansion Tank	Hot Water Heating	1959
2	Flash Tank	Steam/Condensate	1959
3	Condensate Pump	Condensate System	1959
4	Hot Water Circulating Pump	Hot Water Heating	1959
5	Steam to Hot Water Converter	Hot Water Heating	1959
6	Hot Water Recirculating Pump	Domestic Hot Water System	1959
7	Steam-Fired Hot Water Generator	Domestic Hot Water System	1959
8	Pressure Reducing Station	Steam System	1959



BASEMENT MECHANICAL ROOM

SCALE : 1"= 30'–0"

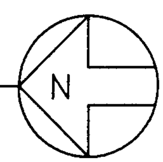


EXHIBIT NO. 29 – BUILDING 621

TABLE NO. 5

EQUIPMENT LIST BUILDING 621

DESIGNATION	DESCRIPTION	SERVICE	DATE INSTALLED
1	Expansion Tank	Hot Water Heating	1959
2	Flash Tank	Steam/Condensate	1959
3	Condensate Pump	Condensate System	1959
4	Hot Water Circulating Pump	Hot Water Heating	1959
5	Steam to Hot Water Converter	Hot Water Heating	1959
6	Hot Water Recirculating Pump	Domestic Hot Water System	1959
7	Steam-Fired Hot Water Generator	Domestic Hot Water System	1959
8	Pressure Reducing Station	Steam System	1959

2. Insulate exterior wall studs with minimum of R-15 foamed insulation.

3. Add ten inches (10") of blown fiberglass insulation to the present attic insulation for an added "R" value of R-22.

4. Replace the present windows and storm windows with thermally broken aluminum windows and bronze tinted insulated glass.

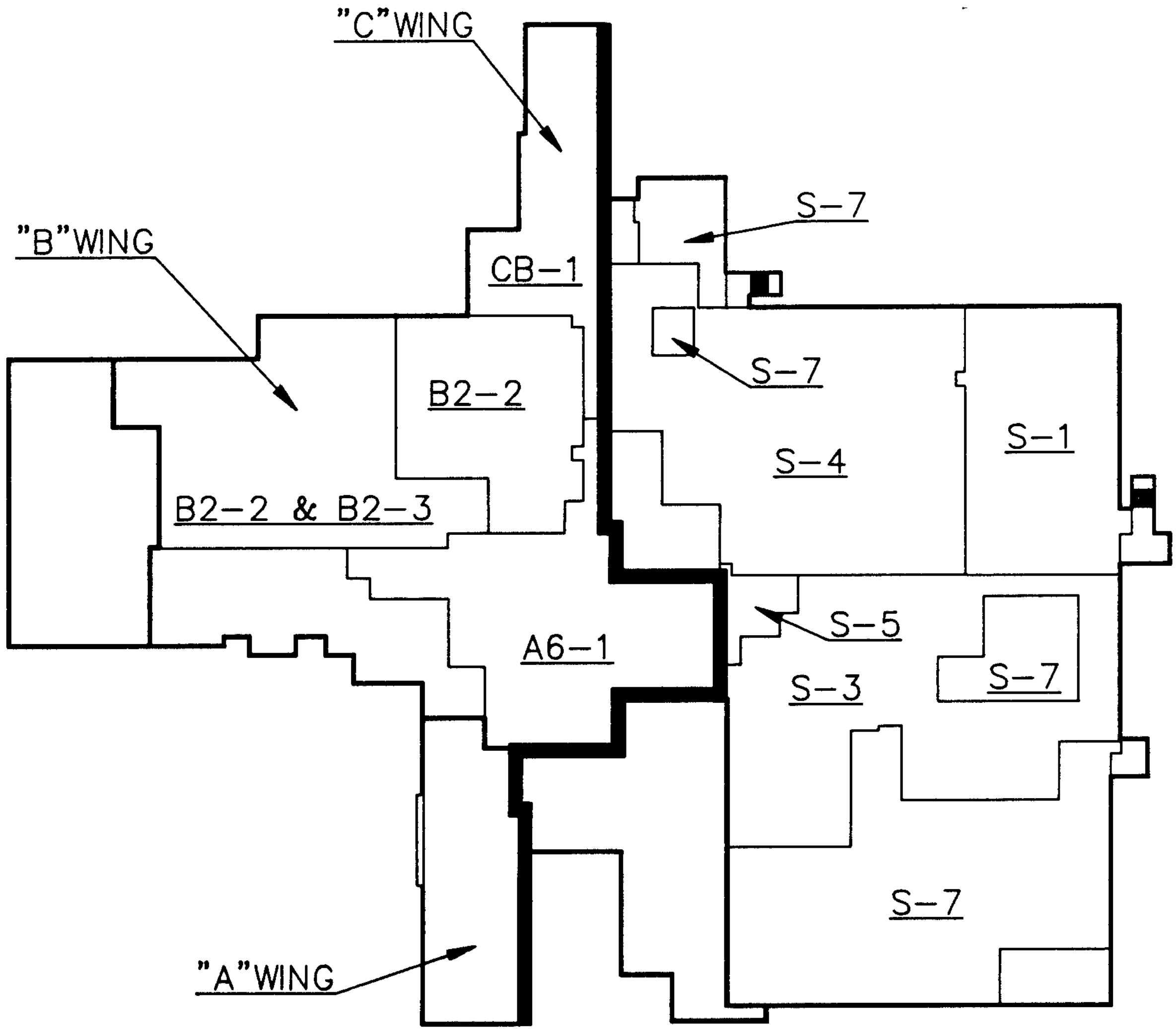
5. Replace present building steam fired domestic hot water and hot water heating equipment with high efficiency gas-fired modular equipment.

6. Reset domestic hot water temperature.

2.2 SYSTEMS AND ZONES DESCRIPTION:

A. To facilitate the development of building computerized energy models, the individual buildings were divided into "zones." The zones were selected based upon the anticipated ECO's to be analyzed, the complexity of the building systems and the physical distribution of the air handling units.

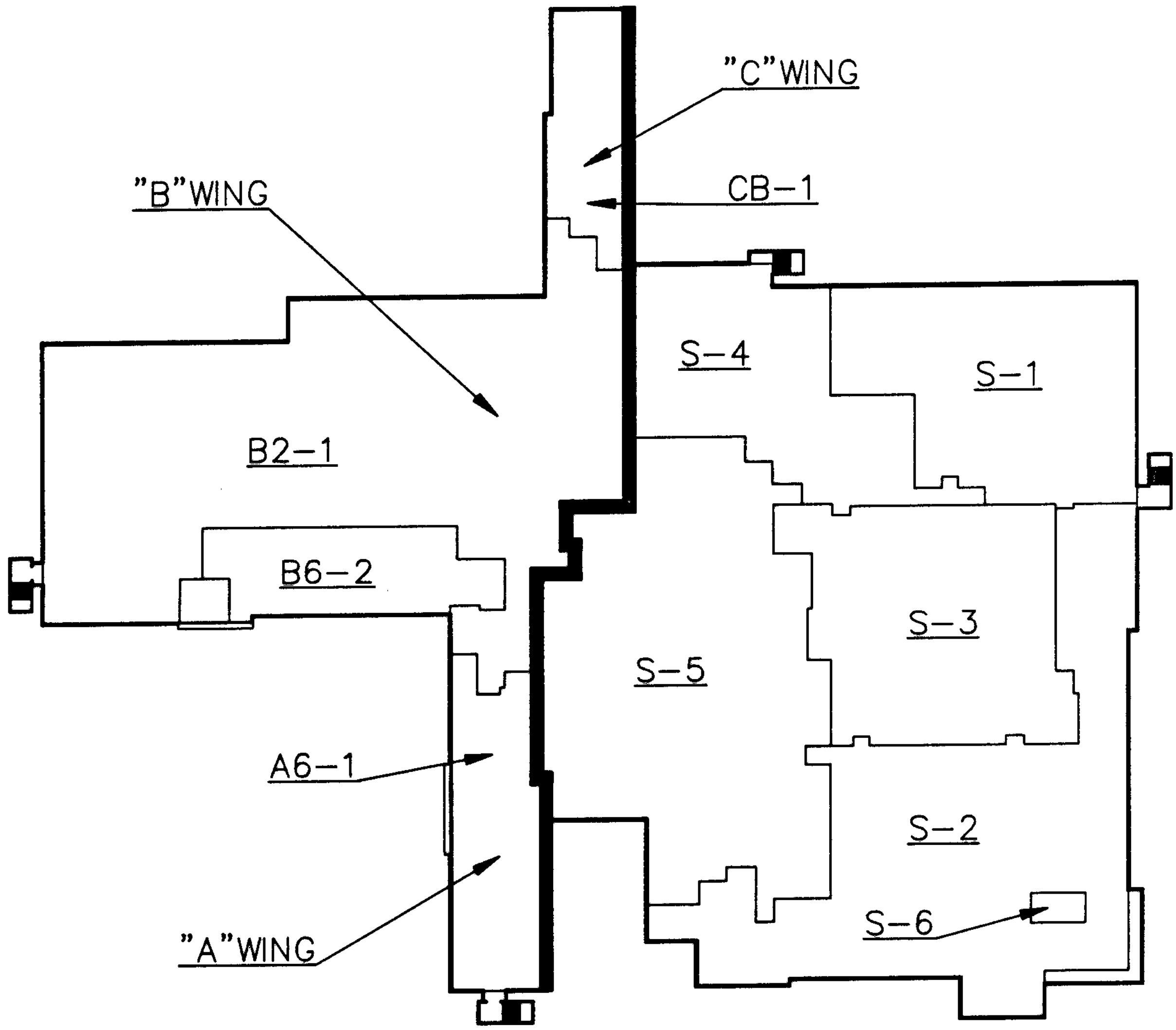
Exhibit No's. 30, 31, 32, 33, 34, 35, 36, and 37 show the areas served by the individual air handling units on a per floor basis in Building 600. Table No's. 6, 7, and 8 provide a listing of the air handling units, the zone number, rooms located in that particular zone and a description of the zone general usage for the Hospital 1955 and 1975 Addition as developed for the computerized energy model. Individual zone miscellaneous equipment, lighting and people loading was developed from information acquired at the facility during site observations and operating personnel interviews. This information can be found in Volume III - Survey Data. Additional information with regard to building coefficients, occupancy schedules and individual zone window/wall areas is included in the appendix of Volume II - Calculations and Analysis.



BASEMENT FLOOR PLAN

SCALE : 1"= 80'-0"

EXHIBIT NO. 30
AIR HANDLING UNIT AREAS, BUILDING 600



FIRST FLOOR PLAN

SCALE : 1"= 80'-0"

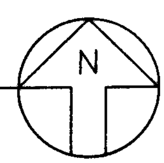
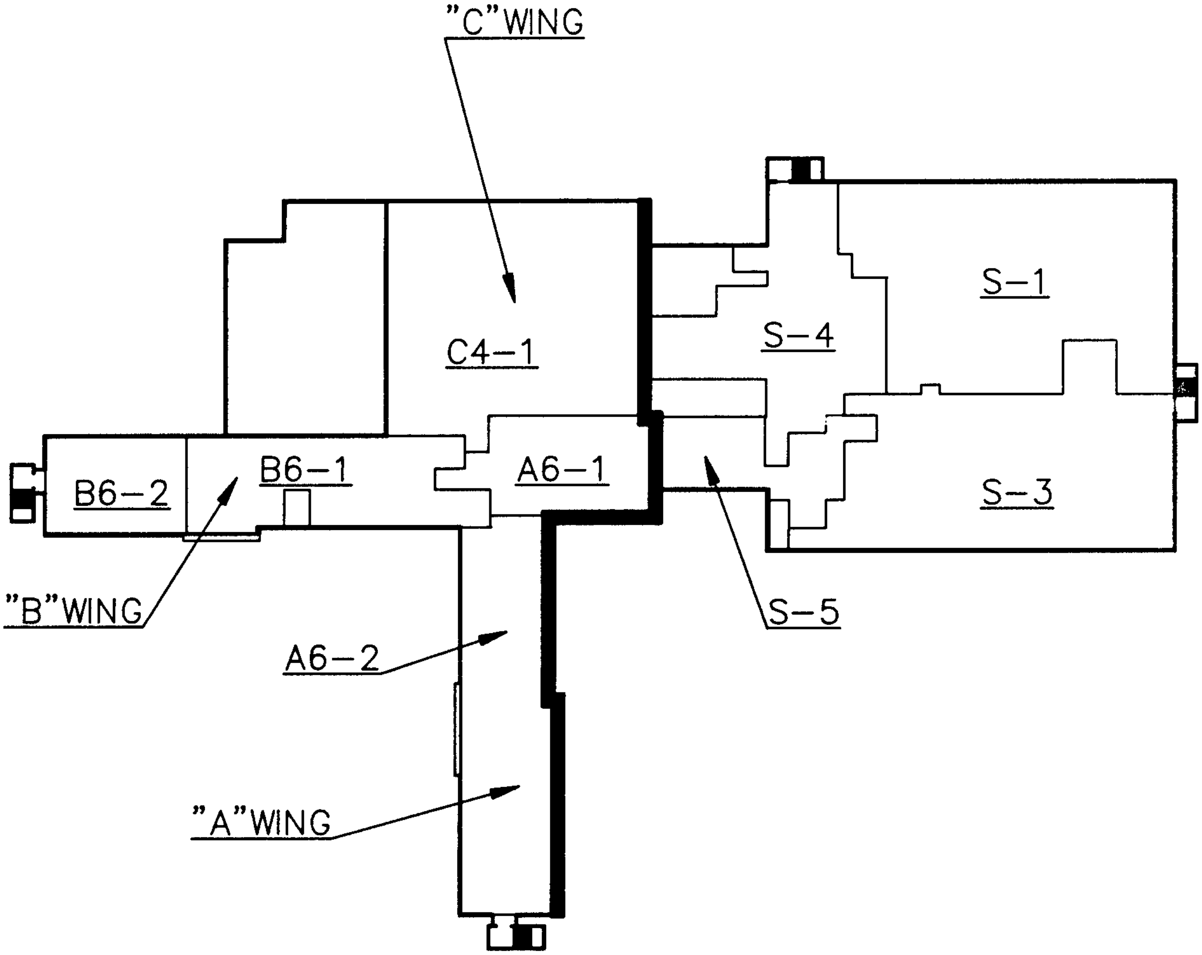


EXHIBIT NO. 31
AIR HANDLING UNIT AREAS, BUILDING 600



SECOND FLOOR PLAN

SCALE : 1"= 80'-0"

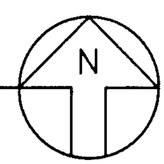
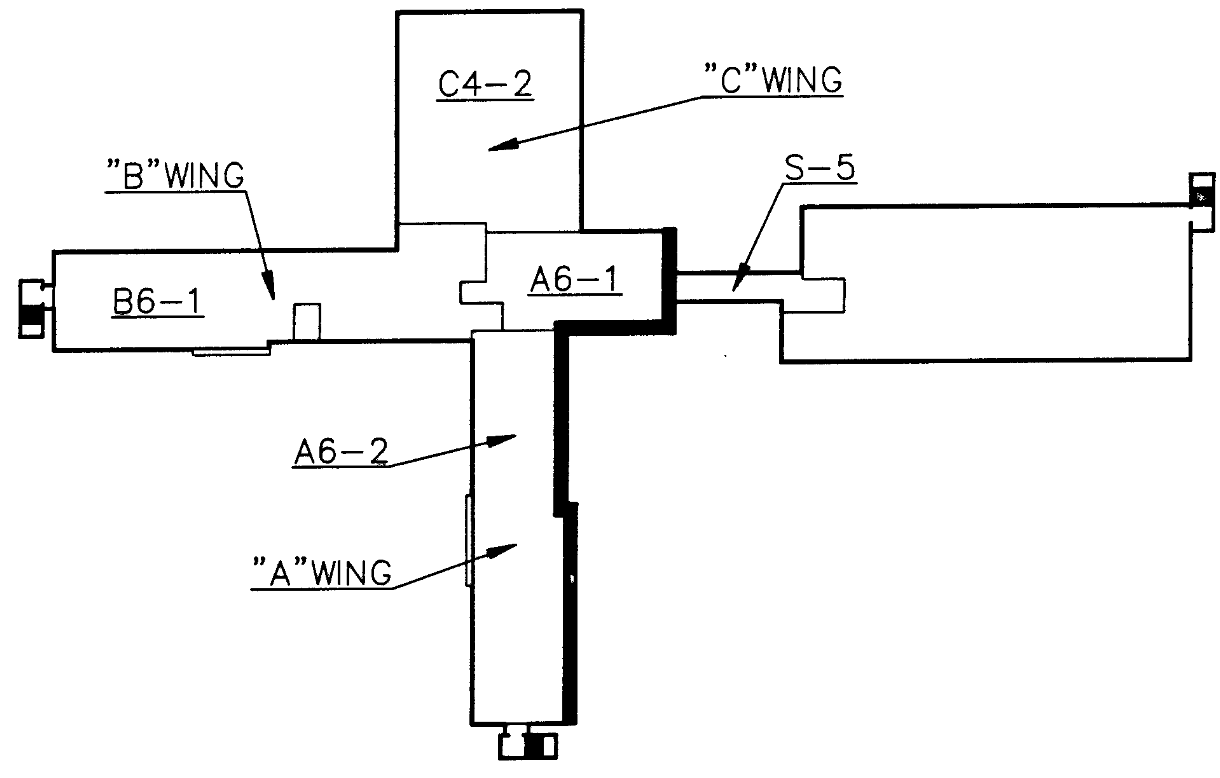


EXHIBIT NO. 32
AIR HANDLING UNIT AREAS, BUILDING 600



THIRD FLOOR PLAN

SCALE : 1"= 80'-0"

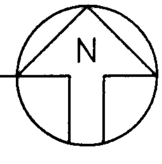
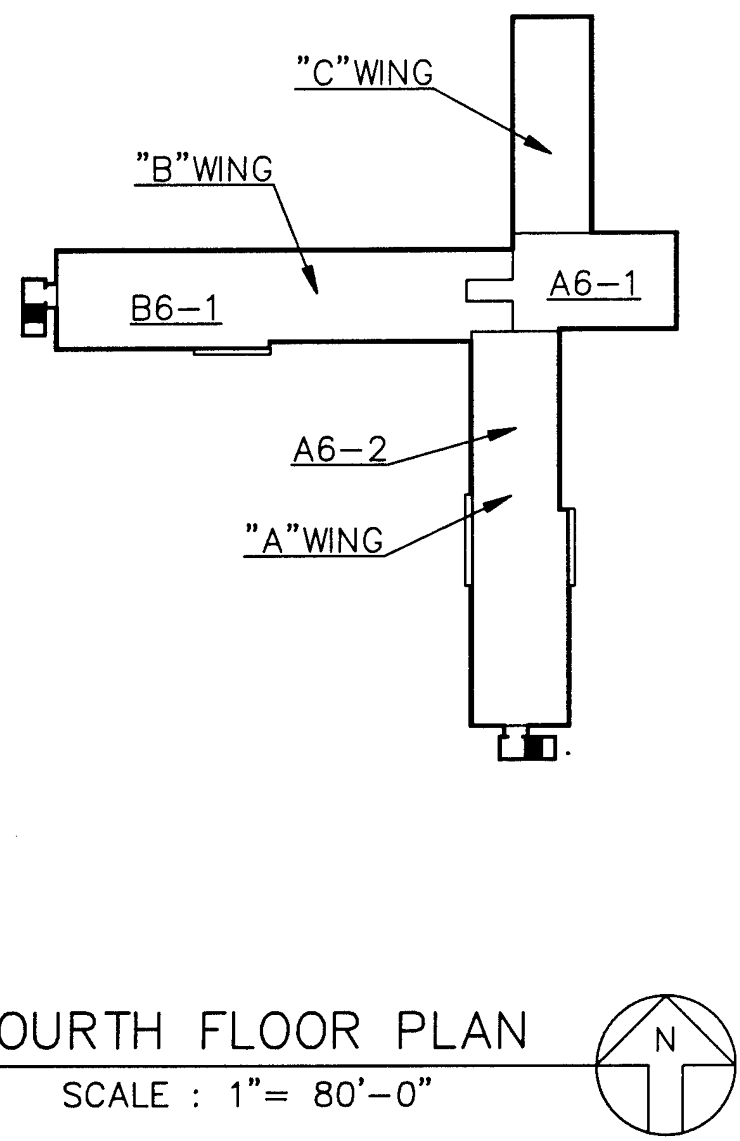


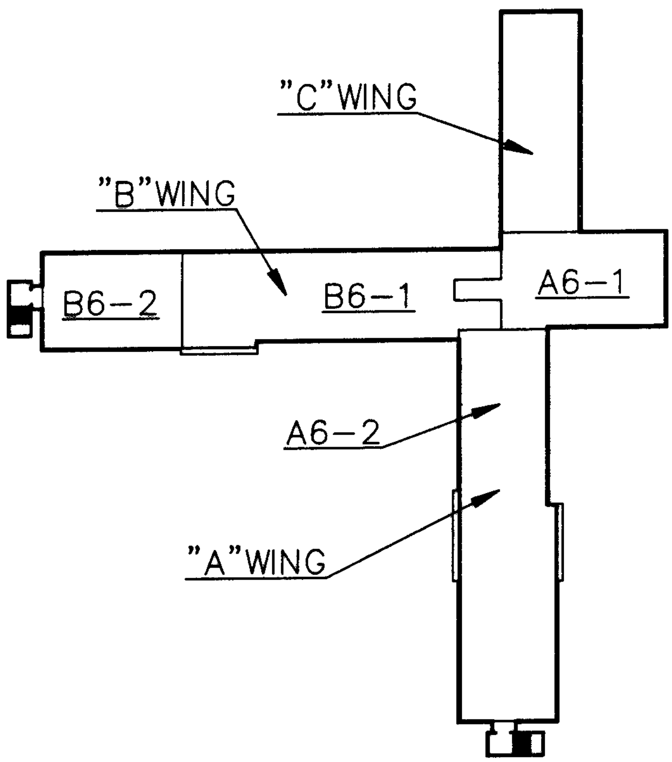
EXHIBIT NO. 33
AIR HANDLING UNIT AREAS, BUILDING 600



FOURTH FLOOR PLAN

SCALE : 1"= 80'-0"

EXHIBIT NO. 34
AIR HANDLING UNIT AREAS, BUILDING 600



FIFTH FLOOR PLAN

SCALE : 1"= 80'-0"

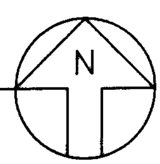
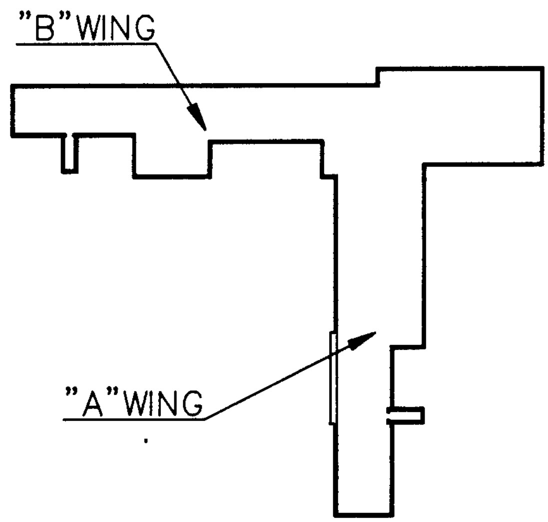


EXHIBIT NO. 35

AIR HANDLING UNIT AREAS, BUILDING 600



SIXTH FLOOR PLAN

SCALE : 1"= 80'-0"

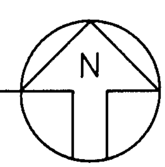


EXHIBIT NO. 36

AIR HANDLING UNIT AREAS, BUILDING 600

P7-1

SEVENTH FLOOR PLAN

SCALE : 1"= 80'-0"

N

EXHIBIT NO. 37

AIR HANDLING UNIT AREAS, BUILDING 600

TABLE NO. 6

COMPUTER MODEL ZONES 1955 HOSPITAL, BUILDING 600

TRACE 600 SYSTEM #	TRACE 600 ZONE #	ROOMS	DESCRIPTION
SYSTEM 1 (AHU A6-1)	301	BG11	POST OFFICE
	302	BG10	AIR COMPRESSOR ROOM
	303	BG4	BARBER
	304	BG1, BG1, BG5, BG13, BG90 to BG95, BN11, BN16 TO BN21, BN23 to BN25, BN27 to BN29, BN90 to BN93	TOILET/LOCKER, STORAGE, CORRIDOR, WAITING, EXAM & OFFICE
	305	BN10, BN12 to BN15	MORGUE & AUTOPSY
	306	BG14	TELEPHONE EQUIPMENT
	307	1G19, 1G22, 1H1 to 1H10, 1J1 to 1J10	CONFERENCE & OFFICES, TOILETS
	308	1H3, 1H90, 1H91	CORRIDOR
	309	2D12, 2D13, 2D15, 2D16, 2D31, 2D32, 2D94, 2H33, 2H91	STORAGE, CORRIDOR, TOILETS
	310	2D33, 2D34, 2H11, 2H12	OFFICE
	311	3G6, 3G7	OFFICE
	312	3D8, 3D15, 3D16, 3D90, 3D93, 3D97, 3G3, 3G92	CORRIDOR, STORAGE, TOILET
	313	4C14 to 4C19	OFFICE
	314	4C8, 4C9, 4C12, 4C90, 4C91, 4C93, 4C95, 4C97	CORRIDOR, TOILETS & STORAGE
	315	5C9 to 5C14	OFFICES
	316	5C3, 5C4, 5C6, 5C90, 5C91, 5C93	CORRIDOR, TOILETS & STORAGE
	317	BN22 (HAS MAKE-UP UNIT)	BRACE SHOP
SYSTEM 2 (AHU A6-2)	318	2D26 to 2D30, 2E1 to 2E91, 2F1 to 2F3	PATIENT AREA "A" WING, SECOND FLOOR
	319	3D19 to 3D21, 3E1 to 3E3, 3E6, 3E10, 3E11, 3E14, 3E15, 3E20, 3E91, 3F3, 3F4, 3F6 to 3F16, 3F19, 3F92	PATIENT AREA "A" WING, THIRD FLOOR

TABLE NO. 6 (continued)

TRACE 600 SYSTEM #	TRACE 600 ZONE #	ROOMS	DESCRIPTION
	320	4C20 to 4C23, 4D1, 4D4, 4D6, 4D10 to 4D17, 4D22, 4D91, 4E1 to 4E7, 4E91	PATIENT AREA "A" WING, FOURTH FLOOR
	321	5C15 to 5C17, 5D1 to 5D5, 5D9 to 5D16, 5D21, 5D90, 5E1 to 5E3	PATIENT AREA "A" WING, FIFTH FLOOR, ALL CLASSROOMS & OFFICES
SYSTEM 3 (AHU B2-1)	322	ALL ROOMS IN 1A, 1B, 1C, 1F PLUS 1D90, 1E1 to 1E23, 1E90, 1G91, 1L6, 1L7, 1M1, 1M3, 1M5, 1M7, 1M10, 1M96, 1G12, 1G13, 1G20, 1G21, 1G91, 1G95	FIRST FLOOR OUTPATIENT CLINIC
SYSTEM 4 (AHU B2-2)	323	BE10, BF1, BF3	DINING & TRAINING
	324	BF2, BF4, BF5	DISHWASH
	325	ALL BASEMENT AREA A & C, BD1 to BD4	KITCHEN & BAKERY
SYSTEM 5 (AHU B6-1)	326	2B1 to 2B4, 2B13, 2B21, 2B22, 2B90, 2D17, 2D20 to 2D25	PATIENT
	327	2B6, 2B7, 2B12, 2B16, 2B17	OFFICES
	328	3B17	CLASSROOM
	329	3A1 to 3A8, 3B1 to 3B22, except 3B17, 3D4 to 3D7, 3D23 to 3D28, 3D91, 3A90, 3B90	PATIENT AREA
	330	4A1 to 4A13, 4B90, 4B92, 4A96	PATIENT AREA
	331	4B1 to 4B20, 4C1, 4C25, 4C26	OFFICE & CONFERENCE
	332	5B3 to 5B26, 5B90	OFFICE & MOBILIZATION SUPPORT
SYSTEM 6 (AHU B6-2)	333	1G6 to 1G8	DENTAL SURGERY
	334	1G9	STERILIZER
	335	1D1 to 1D19, 1D91, 1D92 to 1D96, 1G10, 1G1 to 1G5, 1G90	DENTAL CLINIC

TABLE NO. 6 (continued)

TRACE 600 SYSTEM #	TRACE 600 ZONE #	ROOMS	DESCRIPTION
	336	2A1 to 2A9, 2A90	ICU
	337	5A1	RECOVERY FOR MOBILE O.R.
	338	5A2, 5A6, 5A7, 5B1, 5B2	PATIENT AREA
	339	5A9, 5A10	STERILIZER
	340	5A8, 5A11	MOBILIZATION O.R.'S
SYSTEM 7 (AHU CB-1)	341	BE1 to BE9, BL1, BL91, BK1 to BK10, BK91	LIBRARY & OFFICES
	342	IE25, IE26, 1K1 to 1K13, 1K91, 1L1 THRU 1L5	OFFICES - SOCIAL DISEASE
SYSTEM 8 (AHU C4-1)	343	2C13, 2C19, 2G1, 2G2	O.R.'S
	344	2C2, 2C14 to 2C18, 2C38	SCRUB & STERILIZER
	345	2C3, 2C4, 2C7, 2C36, 2C37	RECOVERY
	346	2C1, 2C9 to 2C12, 2C20, 2C22, 2C23, 2C24, 2C26 to 2C29, 2C32, 2C36, 2C37, 2C90, 2C91, 2C94; 2D4 to 2D6, 2D9, 2D10, 2D91 to 2D93, 2G3, 2G4, 2G8, 2G9, 2G11, 2H1	OFFICES, X-RAY, LOCKER & CORRIDOR
SYSTEM 9 (AHU C4-2)	347	3C26, 3C28, 3C29, 3D2	NURSERY
	348	3C11, 3C12, 3C14, 3C18	DELIVERY
	349	3C15 to 3C17	SCRUB & STERILE
	350	3C9, 3C20 to 3C22	LABOR
	351	3C1 to 3C8, 3C19, 3C23, 3C25, 3C90, 3C91, 3C97, 3D9, 3D10, 3D12, 3D14	EXAM, NURSE STATION

TABLE NO. 7

COMPUTER MODEL ZONES 1975 HOSPITAL, BUILDING 600

TRACE 600 SYSTEM #	TRACE 600 ZONE #	ROOMS	DESCRIPTION
SYSTEM 10 (AHU S-1)	401	BS95, BV1 to BV15, BV90 to BV93, BW1 to BW20, BW90, BW91, BR93, BR95	BASEMENT CLINIC
	402	BW11	INCINERATOR
	403	1R19 to 1R39, 1R90 to 1R94, 1S5, 1S6, 1S92 1V1 to 1V20, 1V90, 1V91, 1W1, 1W2	FIRST FLOOR CLINIC
	404	1R4	PATIENT EXERCISE
	405	2J1 to 2J24, 2J27, 2J91, 2J92, 2K3 to 2K7, 2L1 to 2L13, 2L90, 2L91	SECOND FLOOR ADMINISTRATION
SYSTEM 11 (AHU S-2)	406	1W3 to 1W13, 1X1 to 1X8, 1W91	EMERGENCY SUPPORT
	407	1U20, 1U21, 1U24, 1X10 to 1X17, 1X91, 1X93, 1Y1 to 1Y12, 1Y14 to 1Y17, 1Y91, 1Y92	EMERGENCY
	408	1U22, 1U23	MAJOR TRAUMA
	409	1Z1 to 1Z4	AMBULANCE
	410	1Q2 to 1Q14, 1T28 to 1T41, 1T92, 1U1 to 1U19, 1U90 to 1U95	EXAM/TREATMENT IN OUTPATIENT CLINIC
SYSTEM 12 (AHU S-6)	411	1Y13	E.R. TRAUMA
SYSTEM 13 (AHU S-3)	412	BN26, BP1, BS8, BS9, BT7 to BT12	INPATIENT PHARMACY
	413	BS7, BS10 to BS17, except BS14, BS92, BS93, BT1 to BT5, BT13 to BT16, BT17, BT90, BT91, BX2 to BX8, BX90, BW92	BASEMENT ADMINISTRATION
	414	1S19, 1S20, 1S28, 1S33, 1T7, 1T8, 1T17	X-RAY ROOMS

TABLE NO. 7 (continued)

TRACE 600 SYSTEM #	TRACE 600 ZONE #	ROOMS	DESCRIPTION
	415	1S30 to 1S32	FILM PROCESS
	416	1N31 to 1N37, 1S7 to 1S18, 1S23, 1S29, 1S94, 1S91, 1T1 to 1T6, 1T14, 1T18 to 1T27, 1T90, 1T91, 1X9	DRESSING, VIEW, CORRIDOR, WAITING
	417	2K12 to 2K39, 2M1, 2M5 to 2M17, 2K90 to 2K93, 2M91	AUDIO VISUAL CLINIC
SYSTEM 14 (AHU S-4)	418	BL3, BL9, BL10	PX & TOILET
	419	BM1 to BM5	VOLUNTEER
	420	BL13 to BL15, BM6 to BM8	EEG
	421	BL17 to BL19, BL93, BM9 to BM13, BM90, BR1 to BR18, BR23, BR90 to BR95	PSYCHIATRIC
	422	BM21, BM22, BN9	CENTRAL STERILIZERS
	423	BM14 to BM18, BM20, BR19 to BR22, BN24, BM92, BS1 TO BS6, BS18, BS90, BS91	HOUSEKEEPING
	424	1L8 to 1L16, 1L90 to 1L92, 1M14 to 1M26, 1M29, 1M90, 1M91, 1M93, 1M2, 1M4, 1M6, 1M8, 1M9	ALLERGY CLINIC
	425	1M27 to 1M30, 1M96, 1M95, 1L17, 1R1, 1R5, 1R6, 1R11 to 1R14, 1S1 to 1S4	PHYSICAL THERAPY
	426	2G5 to 2G7, 2G12 to 2G16, 2G18, 2G90 to 2G92, 2H16, 2H18, 2H90, 2J25, 2J26, 2K1	OCCUPATIONAL THERAPY
	427	2G17	O.T. TREATMENT
SYSTEM 15 (AHU S-5)	428	BN93	BASEMENT CORRIDOR
	429	1G17	STERILIZER
	430	1G15, 1G16, 1G18, 1H12, 1N12, 1N25	LAB

TABLE NO. 7 (continued)

TRACE 600 SYSTEM #	TRACE 600 ZONE #	ROOMS	DESCRIPTION
	431	1P2	VENIPUNCTURE
	432	1P5	BLOOD DRAW
	433	1N1 to 1N11, 1N13 to 1N24, 1N26, 1N27, 1N91 to 1N95, 1P1 to 1P4, 1P6, 1P10 to 1P12, 1P90, 1Q1	ADMIN-LAB & CLINIC
	434	1M11 to 1M13, 1M31	DERMATOLOGY WAITING
	435	1N29, 1N30, 1N33, 1P10	RADIOLOGY WAITING
	436	1P7 to 1P9, 1Q15	PHARMACY
	437	1N97, 1N99, 1P91 to 1P95, 1S90	CORRIDORS
	438	2H5 to 2H9, 2H14, 2H22, 2H94	CHAPEL
	439	2H92	HALL
	440	2H19	COMPUTER
	441	3G90	CORRIDOR
SYSTEM 16 (AHU S-7)	442	BT6, BY1 to BY5	BULK STORAGE
	443	BS14, BW19	SOILED LINEN, EQUIPMENT TESTING
	444	BM19	ELECTRIC SUBSTATION
	445	BN1 to BN8, BM25	CLEAN INSTRUMENT
	446	BL11	OFFICE OF PX
	447	BL2, BL6, BL8	SNACK BAR

TABLE NO. 8

COMPUTER MODEL ZONES MISCELLANEOUS AREAS, BUILDING 600

TRACE 600 SYSTEM #	TRACE 600 ZONE #	ROOMS	DESCRIPTION
SYSTEM 17 (HTG ONLY)	501	BD6, BD9 (SINGLE ZONE W/WING STEAM)	MECHANICAL ROOM
SYSTEM 18 (HTG ONLY)	502	BD8, BG7 (SINGLE ZONE W/WING STEAM)	MECHANICAL ROOM
SYSTEM 19 (HTG ONLY)	503	BG6, BG8 (SINGLE ZONE W/WING STEAM)	MECHANICAL ROOM
SYSTEM 20 (HTG ONLY)	504	BD5, BD7, BG9, BK3, BK9, 3D18, 5B20, 5C1, 5C2, 5C2A, BG3, BS7 (UH)	MISC. MECHANICAL ROOMS
	505	SECOND FLOOR PENTHOUSE (UH)	MECHANICAL ROOM
	506	PENTHOUSE 3H1 (UH)	MECHANICAL ROOM
	507	4C7 FOURTH FLOOR PENTHOUSE (UH)	MECHANICAL ROOM
	508	6A1, 6B1, 6C1, 6D1, 6E1 (UH)	SIXTH FLOOR PENTHOUSE-1975
SYSTEM 21 (HTG ONLY)	509	STAIR 1 to 5, STAIR A to F (CABINET UH)	STAIRS
SYSTEM 22 (AHU P7-1)	510	ELEVATOR EQUIPMENT PENTHOUSE	
SYSTEM 23 (ENERGY PLANT)	511	AREAS A, B & C	

Building 610 was divided into ten (10) zones based on function and usage. The zones consisted of basement, two (2) end zones and one (1) core zone per floor for the three floors.

Building 620 and 621 were each divided into two (2) zones with one zone per floor.

2.3 PRESENT ENERGY CONSUMPTION AND COST:

A. GENERAL:

To facilitate the development of an energy consumption model and to determine usage patterns peculiar to the five building hospital complex at Fort Riley, Kansas, historical energy data was gathered for the 1990 fiscal year.

The sources of energy for the five building hospital complex are electricity, fuel oil, and natural gas. The fuel oil usage is a minor part of the total energy consumption for heating and therefore has been average into the natural gas calculations.

Electricity for Irwin Hospital is metered on the primary side of the transformer at the hospital substation located approximately one mile north of the hospital. Our available data regarding electrical usage at Irwin Hospital was derived from this metering point. This data does not represent a totally accurate picture because this substation serves other facilities in addition to the hospital. Since the hospital is by far the largest load on the substation general conclusions can be drawn from this data.

Total consumption data for electrical energy usage as metered at the hospital substation in fiscal year 1990 has been plotted in Exhibit No. 38. Exhibit No. 39 plots the monthly electrical demand (in KW) for the same time periods and metering point. Note that demand normally peaks in July or August, depending upon the demands placed upon the refrigeration units by weather conditions. During the winter months, the electrical consumption is primarily due to lighting and equipment motor loads.

Natural gas consumption for the hospital has been plotted in Exhibit No. 40 and for the Energy Plant in Exhibit No. 41.

Total consumption data for natural gas usage as metered at station #10 and #12, hospital complex, in fiscal years 1985 and 1990 has been plotted in Exhibit No. 42. Fiscal year 1985 depicts the natural gas consumption at the hospital complex prior to the Phase I, II, and III Mechanical/Electrical Upgrade. Fiscal year 1990 depicts the natural gas consumption at the hospital complex after the completion of the construction project. The variation in the profiles during the months of August and September 1990 are due to unusual weather conditions. August 1990 was unusually cool while

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. OF
CALCULATED BY C.R.S. DATE 2-11-91
CHECKED BY RDF DATE
JOB NO. 5080

ELECTRICAL ENERGY USAGE PROFILE

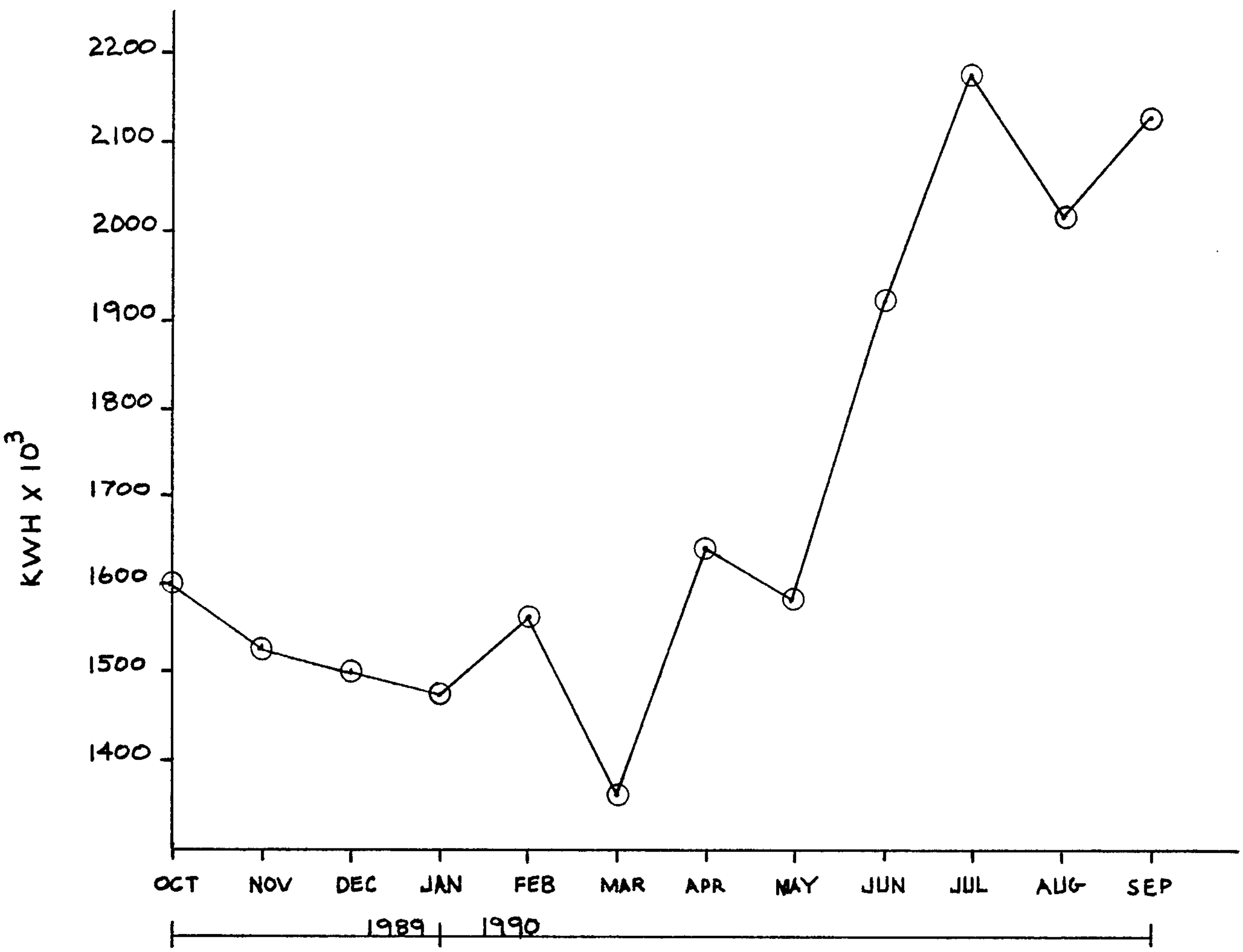


EXHIBIT NO. 38

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas

SHEET NO. ______ OF ______

CALCULATED BY CRS DATE 2-11-91

CHECKED BY RDF DATE ______

JOB NO. 5080

ELECTRICAL DEMAND PROFILE

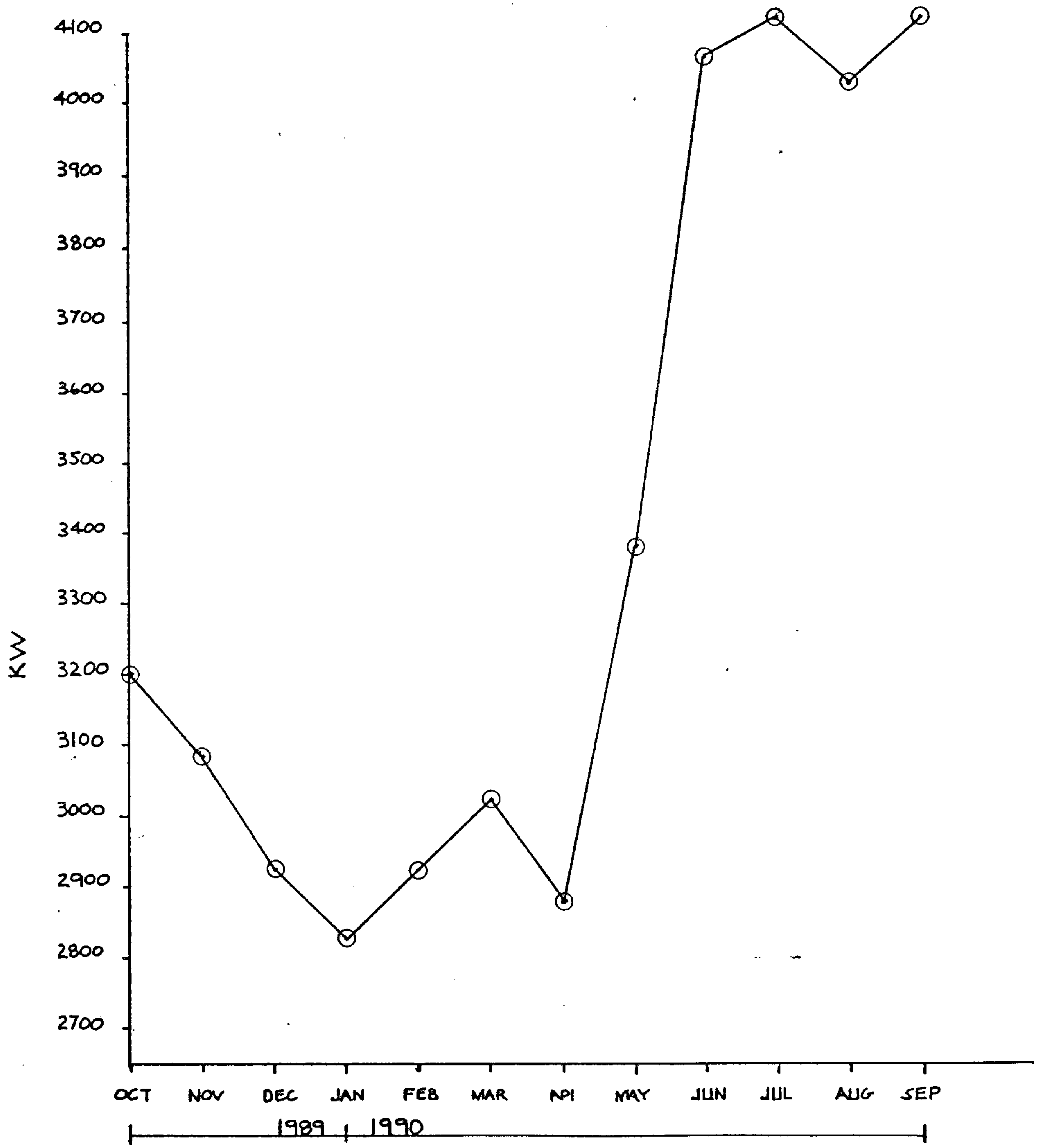


EXHIBIT NO. 39

JOB Irwin EEAP - Ft. Riley, Kansas

SHEET NO. ______ OF ______

CALCULATED BY G.L.B. DATE 2-11-91

CHECKED BY R.D.F. DATE ______

JOB NO. 5080

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

NATURAL GAS USAGE PROFILE
#10

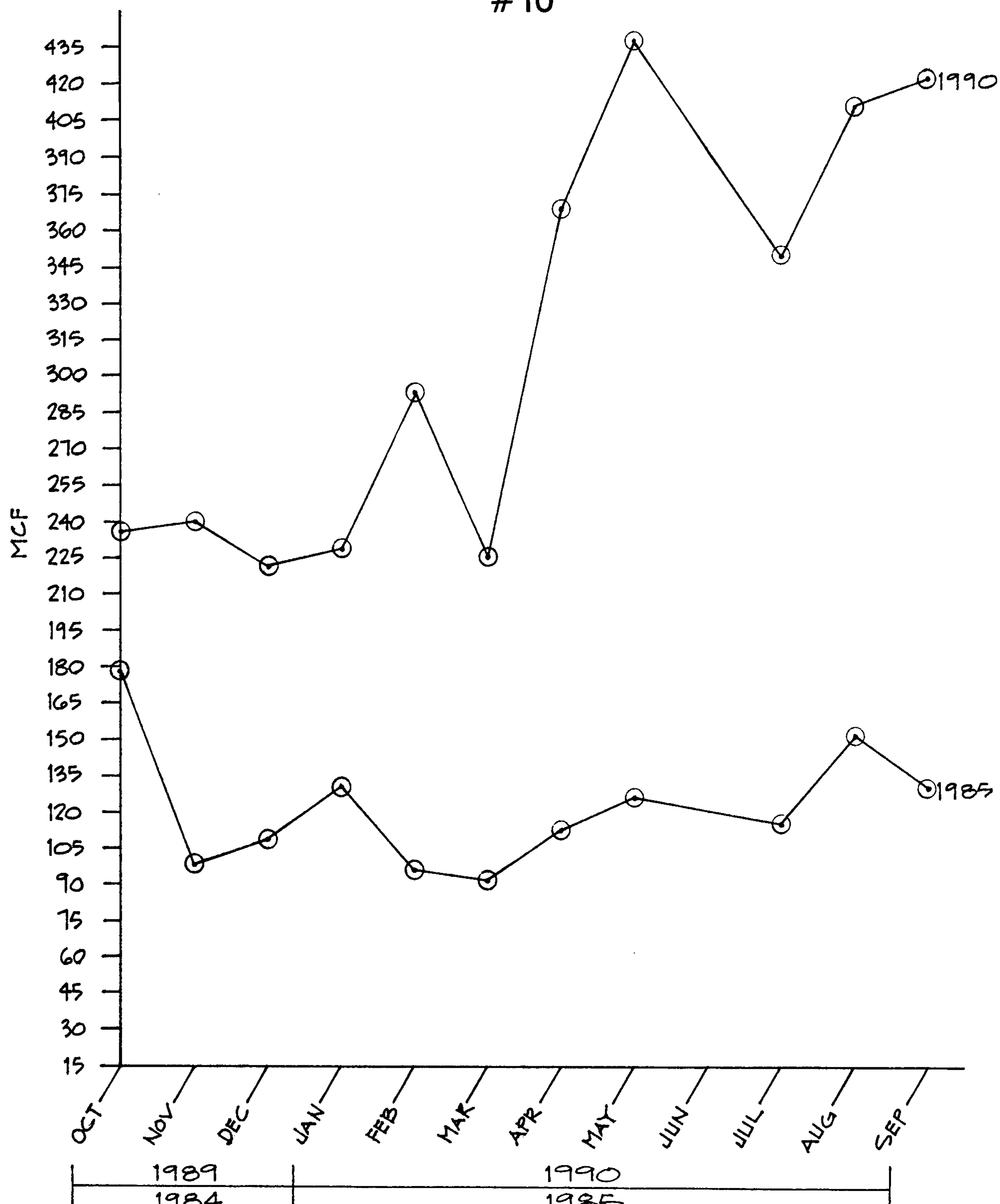


EXHIBIT NO. 40

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. OF
CALCULATED BY G.L.B. DATE 2-11-91
CHECKED BY R.D.F. DATE
JOB NO. 5080

NATURAL GAS USAGE PROFILE
#12

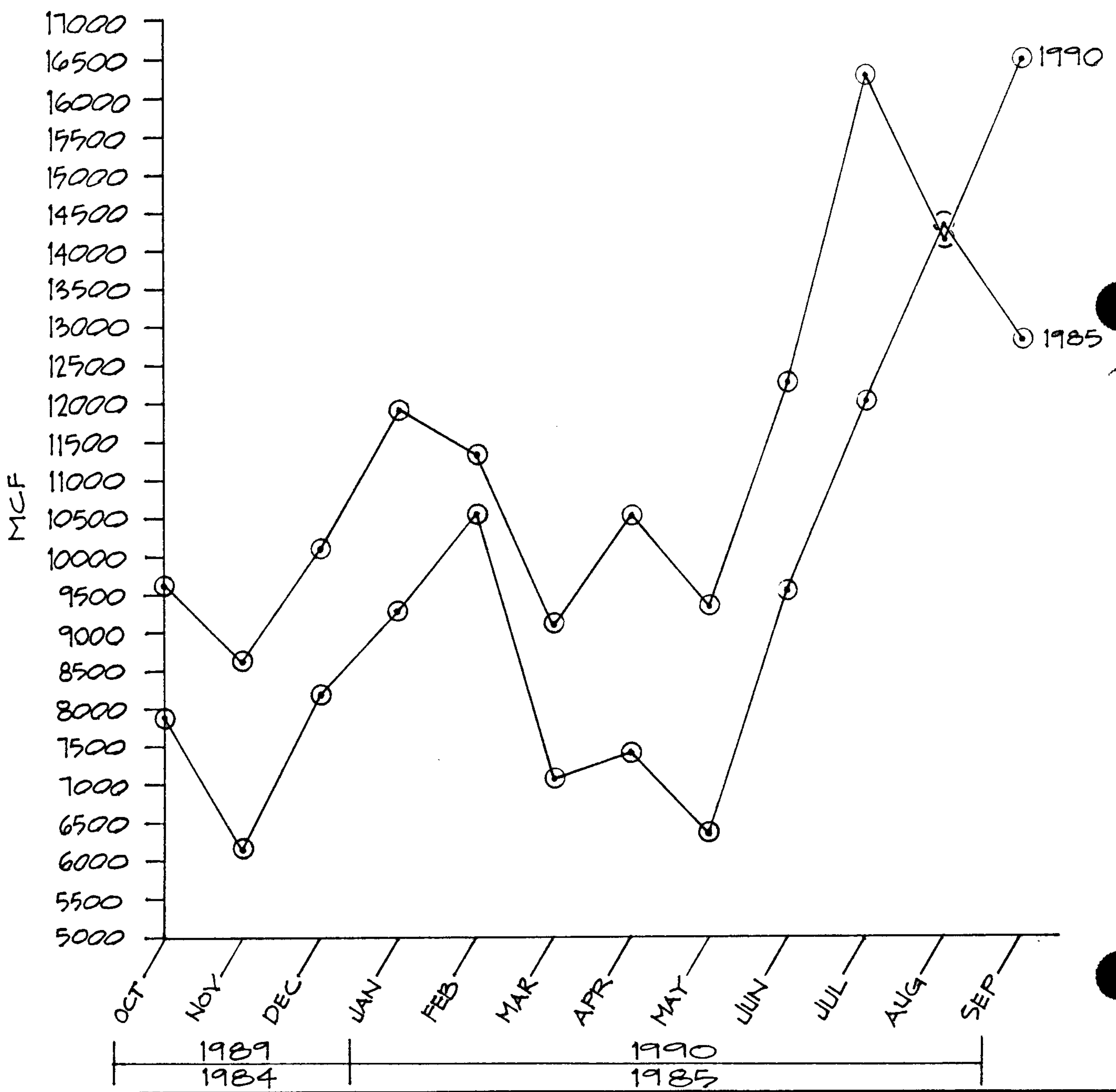


EXHIBIT NO. 41

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. OF
CALCULATED BY G.L.B. DATE 2-11-91
CHECKED BY R.D.F. DATE
JOB NO. 5080

NATURAL GAS USAGE PROFILE
#10 & 12

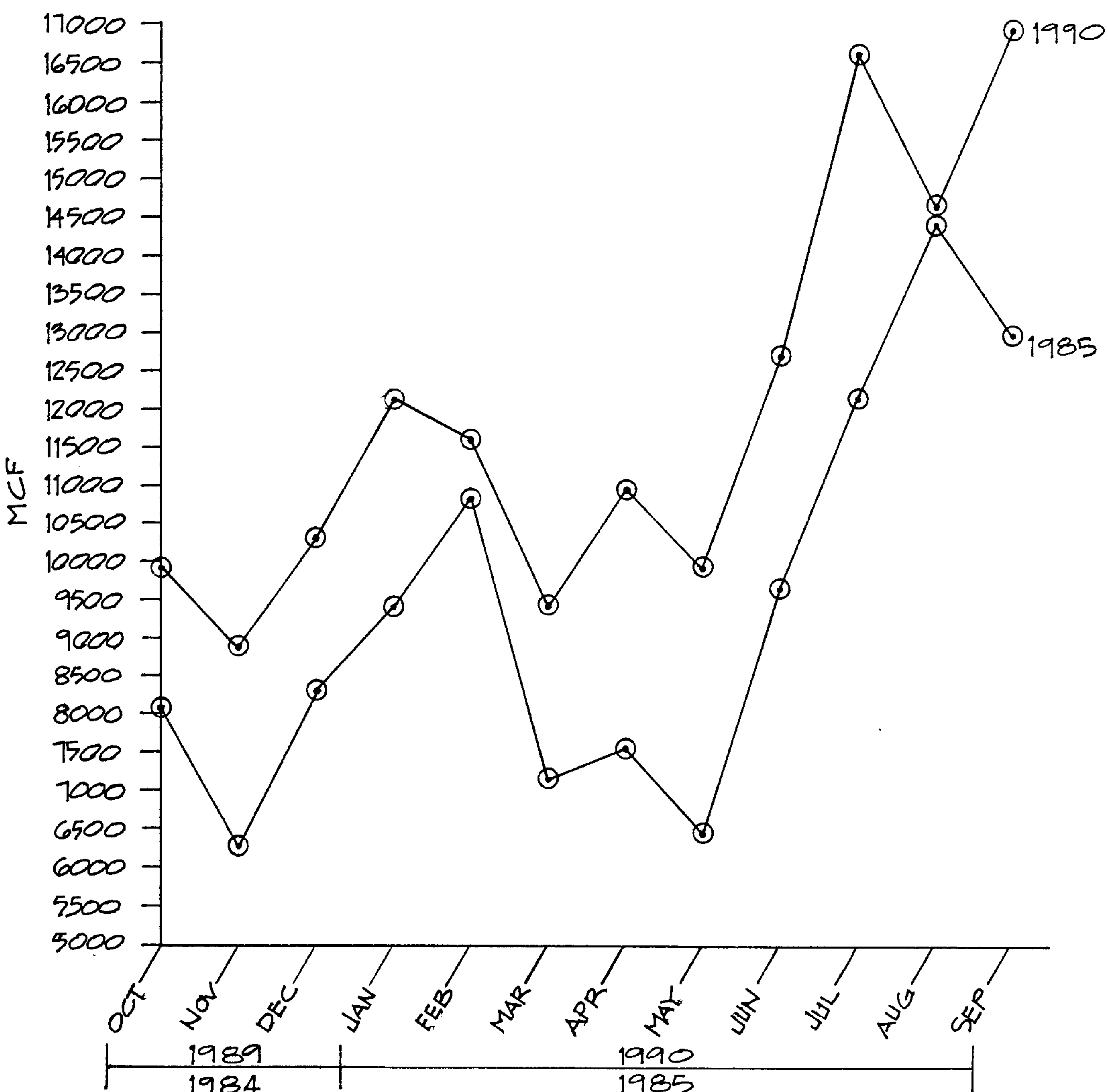


EXHIBIT NO. 42

September 1990 was unusually hot. Note that the peak demand for natural gas as electricity occurs during the months of July and August. This is due to the demand placed on the steam turbine driven refrigeration units used to supplement the electric driven units.

Table No. 9 is a compilation of the total annual energy consumed at the hospital complex based on actual equipment nameplate ratings and computer modeling. Space heating and cooling consume 55 percent of the energy. Of that 55 percent, 14 percent is for AHU fans. The remaining 86 percent is for the boilers, chillers, cooling towers, pumps, etc. Lighting is 4 percent of the energy, and total miscellaneous equipment consumption comprises 28 percent of total energy. Hot water requirements constitute 14 percent of consumption.

Table No. 10 gives the total electrical energy consumed in KWH and the costs for electricity in FY 1990 as metered at the hospital substation. The electrical energy consumption as calculated for the hospital complex is 68.6 percent of the total billed.

Electricity is served to the hospital complex from lines and substation equipment owned and operated by KPL Gas Service Company. Electrical usage is metered for maximum demand in kilowatts and energy consumption in

TABLE NO. 9

HOSPITAL COMPLEX ANNUAL ENERGY USE PROFILE

FUNCTION	*ELECTRICITY*	*GAS*
Cooling/Heating	7.851×10^6 KWH	74,637 MCF
Miscellaneous Equipment	4.026×10^6 KWH	37,845 MCF
Domestic Hot Water	----	25,397 MCF
Lighting	2.256×10^6 KWH	----
TOTAL	14.133×10^6 KWH	137,879 MCF

14.133×10^6 KWH x 3413 BTU/KWH	$= 4.8235 \times 10^{10}$ BTU
137,879 MCF x 1,031,000 BTU/MCF	$= 1.4215 \times 10^{11}$ BTU
TOTAL	1.90389×10^{11} BTU

TABLE NO. 10

HOSPITAL SUBSTATION MONTHLY ELECTRICAL CONSUMPTION AND COST

MONTH	KW BILLING	KW ACTUAL	KWH	COST *
10/89	3216	3216	1,610,400	$61,762.79
11/89	3161	3097	1,531,200	$59,318.08
12/89	3161	2935	1,504,800	$58,607.13
1/90	3161	2832	1,478,400	$57,896.18
2/90	3161	2953	1,555,200	$59,964.40
3/90	3161	3041	1,420,800	$56,288.38
4/90	3161	2888	1,608,000	$60,952.16
5/90	3378	3378	1,579,200	$61,414.73
6/90	4063	4063	1,937,700	$74,768.32
7/90	4136	4136	2,198,400	$82,220.47
8/90	3972	3972	2,047,200	$77,259.59
9/90	4061	4061	2,128,800	$79,939.68
		TOTAL	20,600,100	$790,391.91

* COST IS TOTAL CAPACITY AND ENERGY CHARGES WITHOUT CONSIDERATION OF ENERGY COST ADJUSTMENT.

$$\$/\text{KWH} \quad \frac{790{,}391.91\ \$}{20{,}600{,}100\ \text{KWH}} = 0.038\ \$/\text{KWH}$$

kilowatt-hours. The hospital complex is billed for the metered usage under KPL Company's billing schedule LP1 dated February 1, 1989. Based on this schedule the facility for fiscal year 1990 paid $3.8 cents per kilowatt-hour.

Table No. 11 gives the total natural gas consumed, 143,700 MCF at the hospital complex in FY 1990. The natural gas consumption as calculated for the hospital complex is 95.9 percent of the total billed. This 4.1 percent difference is negligible and can be attributed to the use of an average year weather tape in the computer modeling versus actual weather conditions of fiscal year 1990.

Natural gas is served to all of Fort Riley via pipelines owned and maintained by KPL Gas Service Company. The Fort is charged a base rate plus a "Purchased Gas Adjustment" rider under which the customer is billed the additional cost of purchased gas over the base cost of purchased gas included in the rate base. Table No. 12 gives the base rate/purchased gas adjustment and the average cost per MCF paid in fiscal year 1990. Based on this billing information the facility paid $3.2055 per MCF of natural gas used.

TABLE NO. 11

HOSPITAL COMPLEX MONTHLY GAS CONSUMPTION

MONTH	MCF
10/89	9,859
11/89	8,878
12/89	10,351
1/90	12,135
2/90	11,610
3/90	9,410
4/90	10,899
5/90	9,828
6/90	12,654
7/90	16,615
8/90	14,603
9/90	16,858
TOTAL	143,700

NATURAL GAS FY 90

	MCF	COST-PGA	RATE-PGA	PGA	PGA $ MO.	COST+PGA	RATE+PGA Per MCF
OCT 89 *	46,508	$137,788.45	$2.9627	$.29430	$13,687.30	$151,475.75	$3.2570
NOV 89 *	113,165	$335,193.16	$2.9620	$.29520	$33,406.31	$368,599.47	$3.2572
DEC 89 *	187,151	$554,301.66	$2.9618	$.29820	$55,808.43	$610,110.09	$3.2600
JAN 90 *	245,086	$725,877.19	$2.9617	$.30120	$73,819.90	$799,697.09	$3.2629
FEB 90 *	200,977	$595,248.40	$2.9618	$.31470	$63,247.46	$658,495.86	$3.2765
MAR 90 *	150,016	$444,327.46	$2.9619	$.29260	$43,894.68	$488,222.14	$3.2545
APR 90 *	149,073	$441,534.70	$2.9619	$.25280	$37,685.65	$479,220.35	$3.2147
MAY 90 *	68,635	$203,317.58	$2.9623	$.23650	$16,232.18	$219,549.76	$3.1988
JUN 90 *	44,802	$121,535.63	$2.7127	$.22280	$9,981.89	$131,517.52	$2.9355
JUL 90 *	49,928	$135,434.77	$2.7126	$.21460	$10,714.55	$146,149.32	$2.9272
AUG 90 *	47,262	$128,205.92	$2.7127	$.17370	$8,209.41	$136,415.33	$2.8864
SEP 90 *	48,785	$132,335.54	$2.7126	$.20610	$10,054.59	$142,390.13	$2.9187
TOTALS	1,351,388	$3,955,100.46	$2.9267	$.27878	$376,742.35	$4,331,842.81	$\boxed{\$3.2055}$
FY 89	1,265,016	$3,700,312.96	$2.9251	$.02868	$36,275.76	$3,736,588.72	$2.9538
FY 90-89	86,372	$254,787.50	$.0016	$.25010	$340,466.59	$595,254.09	$.2517
PERCENT	6.83%	6.89%	.05%	872.04%	938.55%	15.93%	8.52%

* IS THIS FISCAL YEAR DATA PER MONTH

TABLE NO. 12

SECTION III - ENERGY CONSERVATION EVALUATION

SECTION III

ENERGY CONSERVATION EVALUATION

3.1 GENERAL:

A. All possible Energy Conservation Opportunities (ECO's) as identified in Annex "A" and Annex "D" were evaluated in the Interim Submittal for applicability and economic advisability; however, due to the on-going preventive maintenance and recent upgrading of the mechanical/electrical systems many of the listed Energy Conservation Opportunities are currently being implemented or did not apply due to equipment or design standard limitations.

Mechanical Systems

1. The recent upgrade of the mechanical systems in the 1955 Hospital building has provided air handling systems with economizer cycles, variable volume fans where applicable and air change requirements in accordance with current design standards.

2. All surveyed air handling units generally exhibited clean coils, clean filters and were well maintained.

3. Existing Energy Management System is being utilized to start/stop and night cycle equipment.

4. All pneumatic controls throughout the hospital and energy plant were recently recalibrated in conjunction with EMCS project. However, the pneumatic controls are showing signs of being out of calibration again. It appears that current staffing of the maintenance section is not adequate to maintain the pneumatic control systems properly. DEH is developing a project to replace the controls with ones that will require less maintenance.

Electrical Systems

1. The recent upgrade of the electrical systems in the 1955 Hospital building has provided equipment with high-efficient motors.

2. Projects which recently bid or have recently started construction will provide the hospital with new emergency generators, transfer switch gear and new elevators with SCR controllers.

3. The facility has implemented an energy conservation program by relamping light fixtures with energy saving lamps.

4. Generally, lighting illumination levels throughout the hospital complex are within current lighting design standards.

5. Power factor for the base year billing (FY 1990) indicates that it is consistently at or near 100 percent.

During the Interim Submittal phase, 37 energy conservation opportunities (ECO's) were evaluated in detail for the five building hospital complex. Each ECO was computer-simulated or manually calculated where applicable to ascertain the potential impact on the hospital complex energy consumption.

Computer simulations were developed utilizing the Trane "TRACE 600" software program. The "TRACE 600" software program was developed by the Trane Company as a tool for performing energy analysis and design optimization. The program calculations are performed in four phases. The first phase is load design. The building envelope, internal loads, schedules and weather data are used to calculate the building heating and cooling loads for a one year period based on approved ASHRAE methods. The second phase is system design. The annual heating and cooling load output from Phase I is used to determine how the chosen systems perform. The third phase is equipment design. In this phase the output from Phase II is used to determine the annual energy

consumed by the various pieces of HVAC equipment serving each system. The fourth phase is economics. Since the COE requires economic analysis be performed using the LCCID program this portion of "TRACE 600" is not utilized for this project. the program uses design weather data to size equipment and typical weather data to calculate energy consumption. The design weather data is input by the User. The typical weather data files are based on a ten year average.

For this study the "TRACE 600" computer program was used first to model the existing Hospital, Nurse Quarters, Barracks 620 and Barracks 621 as they now operate.

Additional input files were then created to model projected energy consumption of various energy conservation measures. A listing of all "TRACE 600" input files are identified in Table No. 13.

As a result of the Interim and Prefinal Submittal calculations and reviewers comments the total number of ECO's were combined and/or pared down to approximately five separate projects for final analysis and calculation. The following is a status summary of the ECO's.

TABLE NO. 13
COMPUTER SIMULATION INPUT FILES

FILE NUMBER	ALTERNATIVE NUMBER	BUILDING	ECO NUMBER	DESCRIPTION
T0015080	1	NURSE QUARTERS	29	EXISTING BUILDING
T0015080	2	NURSE QUARTERS	29	REDUCE WINDOW AREA
T0045080	1	HOSPITAL	-	EXISTING BUILDING
T0045080	2	HOSPITAL	5	NEW WINDOWS; BAKERY, DINING
T0095080	1	HOSPITAL COMPLEX	-	EXISTING BUILDINGS
T0095080	2	HOSPITAL COMPLEX	2	MODULAR GAS BOILERS
T0095080	3	HOSPITAL COMPLEX	14	OFF PEAK BOILER
T0095080	4	HOSPITAL COMPLEX	8	HOT WATER SYSTEM FOR HOSPITAL
T0105080	1	HOSPITAL COMPLEX	23	MODIFY 1975 HVAC
T0105080	2	HOSPITAL COMPLEX	38	MODIFY 1955 HVAC
T0115080	1	HOSPITAL	13	EXISTING BUILDING
T0125080	1	HOSPITAL COMPLEX	23	

ECO-1 Hospital Substation Purchase/New Substation, based on simple payback calculations, did not have merit and was eliminated per reviewers.

ECO-2 District Steam to Buildings #610, 620 and 621 was combined with ECO-14, Off Peak Boiler. The development of these two ECO's into a single project was a logical step since this off peak boiler size was dependent on the reduction of the overall steam demand. Project is titled Off-Peak Boiler.

ECO-3 Steam Boiler Pressure Adjustment was not recommended for further analysis due to extensive modifications required for existing equipment.

ECO-4 Energy Management System was analyzed and recommended for further analysis in the Interim Submittal. However, due to DEH's desire to develop this as a separate project to replace the controls with ones that will require less maintenance, further analysis was stopped. It appears that with the calibration problems the facility is experiencing, a total replacement of existing controls with more reliable and lower maintenance equipment is highly recommended. Based on comments generated from the Prefinal Submittal the pneumatic temperature controls would be replaced with DDC controls under a separate contract. Two control schemes that are recommended for

inclusion in projects 4 and 5 are chiller optimization and boiler optimization.

ECO-5 Window Replacement - Building 600 was combined with hospital entry vestibule modifications, occupancy sensors in 1975 addition for lighting, and window replacement in Building 610 to form a single project titled Window/Door Upgrade and Lighting Revision.

ECO-6 Steam Trap Monitoring System was not cost effective due to the routine preventive maintenance program in effect at the hospital. At reviewers request this ECO was dropped from further consideration.

ECO-7 Condensate Return System was not recommended for further calculation.

ECO-8 Low Temperature Hot Water System as a stand-alone project was evaluated and not recommended for further analysis in the Interim Submittal. However, as part of the chiller replacement project, low temperature hot water was generated from waste heat recovery to be used for building hot water reheat and preheating of domestic hot water.

ECO-9 Outside Air Heat Recovery was not recommended for further calculation due to poor payback.

ECO-10 Chiller Controls were evaluated in the Interim Submittal and not recommended for further analysis as a stand-alone project. However, as part of the chiller replacement project, new chiller controls/pumps will be recommended.

ECO-11 Cooling Tower Desuperheating as a stand-alone project was evaluated and not recommended for further analysis in the Interim Submittal. As a result of the chiller replacement project, the installation of the gas-fired chillers with heat recovery will make the cooling tower desuperheater an even less viable project.

ECO-12 Small Chiller for Winter Operation was combined with ECO-13 Alternate Chiller for evaluation in chiller replacement project.

ECO-13 Alternate Chiller was combined with several separate ECO's to form a single project titled Chillers Replacement. Four different types of chiller were originally analyzed. They were electric centrifugal, gas-fired absorption, steam turbine, and gas-fire engine-driven. Based on comments generated by the Interim Submittal review comments and Prefinal Submittal review comments, the chiller type to study was narrowed down to electric centrifugal, gas-fired absorption, and gas-fired engine-driven. A meeting and on-site visit was held with Fort Riley facilities personnel, CERL and the engineering team. It was decided that the best chiller option is gas

fired engine driven. New calculations were then performed based on comments from CERL. See comments in appendix.

ECO-14 Off-Peak Boiler was combined with ECO-2 District Steam to Buildings #610, 620 and 621. See ECO-2 for additional details. This project was revised based on CERL comments. Replacement burners for the existing boilers with a better turn-down ratio are recommended instead of adding an off-peak boiler.

ECO-15 Boiler Controls Modification was combined with ECO-16, ECO-17 and ECO-18 to form a single project to upgrade the existing boiler from an operational and efficiency standpoint. This project is titled Boiler Controls.

ECO-16 Boiler Induced Draft Fans was combined with ECO-15.

ECO-17 Boiler Blow-down Heat Recovery was deleted due to chillers selected.

ECO-18 Boiler Stack Economizers were combined with ECO-15.

ECO-19 Boiler Water Treatment was not recommended for further analysis due to program currently in effect.

ECO-20 Hospital Entry Vestibule Building No. 600 was combined with ECO-5, ECO-26 and ECO-29 to form a single project. See ECO-5 for additional details.

ECO-21 Variable Speed Pumping was not recommended for further calculation due to poor payback.

ECO-22 1975 Addition Lighting has been evaluated and recommended as part of the Window/Door Upgrade and Lighting Revision.

ECO-23 1975 Addition HVAC System has been combined with ECO-38, 1955 Building HVAC, to form a single project titled HVAC Modifications. Installing two speed motors on the supply fans in the 1975 Addition was discussed with the user. Calculations based on the fan laws were performed. It was decided not to pursue this option due to the following information. Pressure relationships in the space can not be maintained when only the supply fan is adjusted. Due to the fan laws static pressure developed by the air will therefore not be available at the end of long duct runs. The supply duct systems in the 1975 Addition are extensive. There are no terminal boxes so the air distribution cannot be controlled. Air will take the path of least resistance.

ECO-24 OR Unit Chiller was not recommended for further calculation as a stand-alone project. Further consideration was given in evaluation of the alternate chiller configuration in the Energy Plant.

ECO-25 Chilled Water AC for Building 620 and 621 was evaluated in the Interim Submittal and was not recommended for further calculations due to poor payback.

ECO-26 Family Practice, East Dock and N. Dietary Dock Vestibule was evaluated in the Interim Submittal and was not recommended for further analysis due to poor payback.

ECO-27 Window Replacement for Building 620 and 621 was evaluated in the Interim Submittal and was not recommended for further analysis due to poor payback.

ECO-28 New Roof Insulation Building 600, 620 and 621 was evaluated in the Interim Submittal and was recommended for further analysis due to poor payback.

ECO-29 Reduce Window Area Building No. 610 was combined with several other ECO's to form a single project titled Window/Door Upgrade and Lighting Revision. See ECO-5 for additional details.

ECO-30 Wall Insulation Building 620 and 621 was evaluated in the Interim Submittal and was not recommended for further analysis due to poor payback.

ECO-31 Shower Flow Restrictors were evaluated in Interim Submittal and eliminated at the request of the facility personnel due to high maintenance requirements.

ECO-32 Automatic Faucets were evaluated in Interim Submittal and were not recommended for further analysis due to poor payback.

ECO-33 Kitchen Exhaust Hood Shut-off was evaluated and recommended for immediate implementation by facility personnel.

ECO-34 Incinerator was not recommended for further analysis due to poor payback.

ECO-35 Reset Domestic Hot Water Temperature Building 610, 620 and 621, although a substantial amount of energy can be saved, it was not recommended for further evaluation due to limitations of Government regulations.

ECO-36 Instantaneous Water Heaters Building No. 600 was evaluated in the Interim Submittal and was not recommended for further analysis. During the Prefinal Submittal this ECO was re-evaluated under the criteria established by the National Standard Plumbing Code. Utilizing this criteria, this ECO was recommended for immediate implementation by facility personnel.

ECO-37 Peak Shaving for the hospital building was evaluated up through the Prefinal Submittal. Per the reviewers' comments, this ECO has been dropped for consideration due to poor payback.

ECO-38 1955 Building HVAC System Fan Modification was analyzed in the Prefinal Submittal and recommended for further consideration. This ECO was combined with ECO-23 to form a single project titled HVAC Modifications.

ECO-39 Shed Hospital Load for Anzio Peak Shaving was analyzed but not recommended for consideration in the Final Submittal. Since the Fort has plans to totally change the power distribution system, a cogeneration project at Custer Hill was discussed in conjunction with this ECO but is beyond the scope of work for this study. Refer to calculations beginning on page 211.

Table No. 14 highlights the results obtained from the project evaluations and calculations. Contained in the Appendix of this volume is the supporting building information and documentation utilized during the project. Volume 3 of this submittal contains the individual project development documentation and supporting calculations.

TABLE NO. 14

PROJECT SUMMARY

	ELECTRIC SAVINGS			NATURAL GAS SAVINGS			TOTAL PROJECT SAVINGS		RECOMMENDED IMPLEMENTATION	
PROJECT TITLE	KWH/YR	BTU/YR ($X10^6$)	$/YR	MCF/YR	BTU/YR ($X10^6$)	$/YR	BTU/YR ($X10^6$)	$/YR	YES	NO
1 Window/Door Upgrade & Lighting Revision	280,054	955.8	10,638	1,973.5	2,034.7	7,305	2,990.5	17,943	X	
2 HVAC Systems Modifications	3,169,487	10,817.5	120,440	12,766	13,161.8	47,250	23,979.3	167,690	X	
3 Boiler Controls	31,526.5	107.6	1,197	5,565	5,738	20,599	5,845.6	21,796	X	
4 Boiler Burner/ Modular Boiler	65,399	223.2	2,484	27,863	28,726.7	103,129	28,949.9	105,613	X	
5 Chiller Replacement	1,579,573	5,391	60,002	-2,839	-2,927	-10,508	2,464	49,494	X	

ANZIO SUBSTATION

Electricity for Irwin Hospital is metered at the hospital substation located approximately one mile north of the hospital. With minor exception, electricity for the rest of Ft. Riley is metered at Anzio substation.

Two major components of the electrical bill are the capacity charge (demand) and energy charge (usage). The energy charge is based on the amount of electricity used. The capacity charge is based on the rate at which electricity is used.

If a customer uses electricity at a high rate (such as running a large motor for a short time) the utility company must operate and maintain the generating capacity to supply electricity at that high rate. The utility company is compensated for this additional generating expense by utilizing the capacity charge. The minimum capacity charge is determined by a percentage of the customer's peak demand during the summer months.

This minimum capacity charge is carried through the winter months. If the demand peaks could be shaved through the summer months savings could be realized throughout the year. If the Hospital substation was connected to Anzio substation, then as the load rises, the Hospital substation could be switched to auxiliary generators effectively shaving this load from the peak demand of Anzio substation.

This project analyzed the feasibility of connecting the Hospital substation and switching (shedding) this load to a separate generator for peak shaving.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Riley, KS REGION NO.: 2 PROJECT NO.:
PROJECT TITLE: Anzio Peak Shaving FISCAL YR.: 1995
DISCRETE PORTION NAME:
ANALYSIS DATE: Mar. 1992 ECONOMIC LIFE 20 YEARS PREPARED BY: CRS

1. INVESTMENT
   A. CONSTRUCTION COST $ 1,480,797
   B. SIOH $ 88,848
   C. DESIGN COST @ 5% $ 74,040
   D. SALVAGE VALUE @ 15% - $ 222,120
   E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) $ 1,421,565

2. ENERGY SAVINGS (+) / COST (-)
   ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	COST $/MBTU/YR(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$		$		$
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 3.59	-46,646	-$ 167,459	17.43	-$ 2,918,813
E. COAL	$		$		$
F. TOTAL		-46,646	-$ 167,459		-$ 2,918,813

3. NONENERGY SAVINGS(+) / COST (-)
   A. ANNUAL RECURRING (+/-) + $ 347,534
      (1) DISCOUNT FACTOR (TABLE A) 12.97
      (2) DISCOUNTED SAVING/COST (3A X 3A1) + $ 4,507,516

   B. NONRECURRING SAVINGS (+) / COST (-)

ITEM	SAVINGS(+) COST(-)(1)	YEAR OF OCCURRANCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-) (4)
(1)	$			$
(2)	$			$
(3)	$			$
(4) TOTAL	$ -0-			$ -0-

   C. TOTAL NONENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3BD4) $ +4,507,516

   D. PROJECT NONENERGY QUALIFICATION TEST
      (1) 25% MAX NONENERGY CALC (2F5 X .33) $ -963,208
         a. IF 3D1 IS = OR > 3C GO TO ITEM 4
         b. IF 3D1 IS < 3C CALC S1R = (2F5+3D1) / 1E = 2.73
         c. IF 3D1b IS = > 1 GO TO ITEM 4
         d. IF 3D1b IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1d / YEARS ECONOMIC LIFE) $ 180,075

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 1,588,703

6. DISCOUNTED SAVINGS RATIO (IF < 1 PROJECT DOES NOT QUALIFY) (SIR) = (5 / 1E) = 1.11

7. SIMPLE PAYBACK PERIOD (ESTIMATED YEARS) SPB=1E/4 7.89

ASSUMPTIONS

1. The four months of the cooling season (June, July, August and September) contain 122 days. Assuming peak shaving will be required for eight hours per day, the annual running time will be 976 hours.

2. The load at the hospital will be adjusted by secondary circuit switching to make full hospital load available for peak shaving.

3. The utility company provided capacity and consumption data for June 1990 thru April 1991 (11 months). Data for May 1990 is best estimate from available data.

4. The purchase price for the hospital substation is an estimate based on telephone conversations with KPL, the current owner. Written price conformation has been requested.

5. The fuel cost adjustment factor has been removed from all billing data. This is a variable factor which is dependent upon the utilities monthly operating cost.

6. An economic life of 20 years based on expected operating life of power lines and equipment.

7. The fuel cost is based on typical fuel consumption for generators of this type using natural gas as fuel. The full load fuel consumption of the generators is estimated at 46.3 mcf/hour of natural gas. The current cost of natural gas is $3.70 per mcf.

8. Facility personnel have indicated that annual maintenance cost of a typical substation of this size at $2,500 per year which includes Government personnel cost, supplies and contracted services.

9. Routine maintenance on a generator of this size has been determined through discussions with equipment manufacturers, to be approximately $.002/kwh. At 4,000 kw generator size and with 976 running full load hours/year the annual generator maintenance cost is $7,808/year. This includes oil, miscellaneous supplies and personnel.

10. Generator location near hospital substation where waste heat from engine exhaust and jacket cooling water could not be readily recovered.

The electric rates for Ft. Riley are structured such that the more electricity that is purchased the lower the unit cost becomes. So there is a cost advantage to connecting the Hospital substation to Anzio substation. More electricity will be purchased on the meter at Anzio so that unit cost will be lower. The electric utility company, KPL, has placed a device (a translator) on both substations which combines the meter readings. From this data it is possible to compare the annual cost of the two substations separately and combined. Our comparison indicates an annual savings in excess of $64,000.00. See attached tabulation titled Combination of Anzio and Hospital Substation.

The minimum capacity charge (demand) is based on a contract minimum, the actual amount or 80 percent of the summer peak, whichever is greatest. If the peak summer demand of 38,177 kw is reduced by 4,000 kw then at 80 percent of the peak demand the new minimum capacity charge becomes 27,341 kw. Which is very close to the estimated average demand. The maximum demand on the hospital is just at 4,000 kw and occurs at about the same time as the peak demand at Anzio.

This makes it an ideal load to shed for peak shaving. From the data available, the annual savings from peak shaving is estimated at $293,000.00 See attached tabulation titled Combination of Anzio and Hospital Substations Reflecting Peak Shaving.

TOTAL NONENERGY SAVINGS:

[Peak Shaving + Substation Combination] - [Generator Maintenance + Substation Maintenance]

[$293,826 + $64,016] - [$7,808 + $2,500] = $347,534 annually

CONSTRUCTION COST:

Purchase of Hospital substation and building new line	= $530,797
Install generator, switches, controls, etc.	= $950,000
Total	$1,480,797

ANNUAL GENERATOR FUEL COST:

46.3 mcf/hour * (976 hours/year) * ($3.70/mcf) = $167,199

SIMPLE PAYBACK:

$$\frac{\text{Construction Cost}}{(\text{Savings - Maintenance - Fuel Cost})}$$

$$\frac{1{,}480{,}797}{(357{,}843 - 10{,}308 - 167{,}199)} = 8.2 \text{ years}$$

This project, while having a simple payback of less than 10 years and a SIR greater than 1.0, does not meet ECIP criteria since 75 percent of the total discounted dollar savings is not directly resulting from energy savings. Disregarding this ECIP test failure, this project is still recommended to be implemented through other funding programs. Currently, the project calculations do not consider the energy saved due to the waste heat available for recovery from the generator exhaust (69,325 Btu/min per 2,000 KW) and cooling water jacket (141,175 Btu/min per 2,000 KW). This energy savings was excluded from the calculations due to the remote location of the generators. If the generators could be located nearer a facility that could utilize this waste heat (i.e. Custer Hill) then the payback would be less than 7 years.

COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT	Irwin Army Community Hospital - EEAP
LOCATION	Fort Riley, Kansas
INVITATION/CONTRACTOR	
CODE (Check one)	[X] A [ ] B [ ] C [ ] OTHER
EFFECTIVE PRICING DATE	January 1991
DRAWING NO.	—
ESTIMATOR	WB
DATE PREPARED	March 1991
SHEET 1 OF 2 SHEETS	
CHECKED BY	R. D. Frymire

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
Furnish & Install													
34.5KV Line													
From Hospital													
Sub to Anzio											222,000		
Sub.	3	Mile	@	74,000/Mile									
Buy Exist.													
Hospital Sub											100000.		
From KPL	1	LS											
TOTAL THIS SHEET											322000.		

DA FORM 5418-R, Apr 86

NEW LINE AND SUBSTATION

COST ESTIMATE ANALYSIS For use of this form, see TM 5-800-2; the proponent agency is USACE.	INVITATION/CONTRACTOR	EFFECTIVE PRICING DATE January 1991	DATE PREPARED March 1991
PROJECT Irwin Army Community Hospital - EEAP	CODE (Check one) [X] A [ ] B [ ] C	DRAWING NO. RECAP	SHEET 2 OF 2 SHEETS
LOCATION Fort Riley, Kansas	[ ] OTHER	ESTIMATOR WB	CHECKED BY R. D. Frymire

TASK DESCRIPTION	QUANTITY: NO. OF UNITS	QUANTITY: UNIT MEAS	LABOR: MH UNIT	LABOR: TOTAL HRS	LABOR: UNIT PRICE	LABOR: COST	EQUIPMENT: UNIT PRICE	EQUIPMENT: COST	MATERIAL: UNIT PRICE	MATERIAL: COST	TOTAL	SHIPPING: UNIT WT	SHIPPING: TOTAL WT
SHEET 2 OF 2											322,000.		
SUB TOTAL											322000.		
Sub Contractor	O.H.	15%									48300.		
Sub Contractor	Profit	10%									32200.		
Sub total											402500.		
Prime Contractor	O.H.	15%									60375		
Prime Contractor	P&B	10%									40250.		
Sub total											503125		
Contingencies		5.5%									27672.		
Sub total											530797.		
SIOH		6.0 %									31848.		
TOTAL THIS SHEET											562645		

DA FORM 5418-R, Apr 86

NEW LINE AND SUBSTATION

COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT	Irwin Army Community Hospital - EEAP
LOCATION	Fort Riley, Kansas
INVITATION/CONTRACTOR	
CODE (Check one)	[X] A [ ] B [ ] C [ ] OTHER
EFFECTIVE PRICING DATE	January 1991
DRAWING NO.	—
ESTIMATOR	WB
DATE PREPARED	August 1991
SHEET	1 OF 2 SHEETS
CHECKED BY	R. D. Frymire

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
FURNISH AND INSTALL													
THE FOLLOWING:													
GENERATOR (2)													
2000 KW													
4160 KV													
3 ϕ	1	LS									292000.		
SUBSTATION MOD'S:													
INCLUDE SWITCHES,													
CONTROLS, SWGR.,													
CIRC. BRK'S. OIL													
FILLED, TRANSFORMER'S													
ETC.	1	LS									428,379.		
TOTAL THIS SHEET											720379.		

DA FORM 5418-R, Apr 85

NEW GENERATORS

COST ESTIMATE ANALYSIS For use of this form, see TM 5-800-2; the proponent agency is USACE.	INVITATION/CONTRACTOR	EFFECTIVE PRICING DATE January 1991	DATE PREPARED August 1991
PROJECT Irwin Army Community Hospital - EEAP	CODE (*Check one*) [X] A [ ] B [ ] C	DRAWING NO. ←	SHEET 2 OF 2 SHEETS
LOCATION Fort Riley, Kansas	[ ] OTHER	ESTIMATOR WB	CHECKED BY R. D. Frymire

TASK DESCRIPTION	QUANTITY: NO. OF UNITS	QUANTITY: UNIT MEAS	LABOR: MH UNIT	LABOR: TOTAL HRS	LABOR: UNIT PRICE	LABOR: COST	EQUIPMENT: UNIT PRICE	EQUIPMENT: COST	MATERIAL: UNIT PRICE	MATERIAL: COST	TOTAL	SHIPPING: UNIT WT	SHIPPING: TOTAL WT
SHEET 2 OF 2	(	Sub	total		)						720379.		
PRIME CONTRACTOR	O.H.	15%									108057.		
PRIME CONTRACTOR	PROFIT	&	Bond	10%							72038.		
Sub total											900474.		
CONTINGENCIES	5.5	%									49526.		
CONSTRUCTION COST											950,000.		
SIOH	6%										57,000.		
TOTAL THIS SHEET											1007000.		

DA FORM 5418-R, Apr 85

NEW GENERATORS

COMBINATION OF ANZIO AND HOSPITAL SUBSTATIONS

MONTH	ACTUAL KVA*	MONTH KWH**	CONSUMPTION COST COMBINED	CONSUMPTION COST SEPARATE
May 1990	***31,077	10,609,200	$448,984.94	$448,984.94
June 1990	35,808	13,844,400	$564,068.10	$566,930.88
July 1990	38,177	18,878,400	$712,286.33	$719,224.90
August 1990	34,176	14,437,200	$571,998.47	$584,280.14
September 1990	37,819	18,958,800	$712,471.54	$719,324.00
October 1990	30,542	12,267,600	$494,278.96	$498,755.88
November 1990	30,542	11,930,400	$484,659.12	$488,843.27
December 1990	30,542	14,032,800	$541,339.19	$546,896.14
January 1991	30,542	13,314,000	$522,175.98	$527,669.57
February 1991	30,542	10,196,000	$434,615.88	$440,430.98
March 1991	30,542	10,618,800	$446,806.35	$451,302.01
April 1991	30,542	9,345,600	$410,061.80	$415,120.50
TOTALS			$6,343,746.66	$6,407,763.21
			DIFFERENCE	$64,016.55

* DEMAND AT BOTH SUBSTATIONS AS COMBINED BY UTILITY CO. TRANSLATOR (TIME OF DAY CORRECTED).

** SUM OF KWH FROM BOTH SUBSTATIONS.

*** FIGURE GIVEN IS BEST ESTIMATE FROM AVAILABLE DATA.

COMBINATION OF ANZIO AND HOSPITAL SUBSTATIONS
REFLECTING PEAK SHAVING

MONTH	ACTUAL KVA	MONTH KWH	CONSUMPTION COST
May 1990	*31,077	10,609,200	$448,984.94
June 1990 **	31,808	12,884,400	$517,647.86
July 1990 **	34,177	17,886,400	$663,959.61
August 1990 **	30,176	13,445,200	$523,671.75
September 1990 **	33,819	17,998,800	$664,997.94
October 1990	***27,341	12,267,600	$476,769.49
November 1990	***27,341	11,930,400	$467,779.73
December 1990	29,209	14,032,800	$534,047.68
January 1991	***27,341	13,314,000	$504,666.51
February 1991	***27,341	10,196,000	$419,911.75
March 1991	***27,341	10,618,800	$432,113.76
April 1991	27,341	9,345,600	$395,369.21
TOTALS			$6,049,920.23
**** DIFFERENCE			$293,826.43

* FIGURE GIVEN IS BEST ESTIMATE FROM AVAILABLE DATA.

** ADJUSTED FOR PEAK SHAVING OF 4,000 KW.

*** NEW MINIMUM IS (34,177).80 = 27,341

**** (ANNUAL TOTAL) - (ANNUAL TOTAL WITH PEAK SHAVING)

Date: May 1990

TOTAL ENERGY - KWH	10,609,200
BILLING CAPACITY - KVA	31,077

CAPACITY CHARGE				
(200) First		200 KVA of Billing Capacity @ $4.45 =		$890.00
(400) Next		400 KVA of Billing Capacity @ $4.25 =		$1,700.00
Additional		30,477 KVA of Billing Capacity @ $4.05 =		$123,431.85
TOTAL KVA		31,077		$126,021.85
Ownership (Y/N)?	Y	Less Substation Ownership Discount @ $.20/KVA =		($6,215.40)
				$119,806.45
ENERGY CHARGE				
50 x	31077 =	1,553,850 KWH @ 0.03726 =	$57,896.45	
100 x	31077 =	3,107,700 KWH @ 0.03206 =	$99,632.86	
250 x	=	5,947,650 KWH @ 0.02886 =	$171,649.18	
EXCESS	=	0 KWH @ 0.02666 =	$0.00	
TOTAL KVA		10,609,200	$329,178.49	

Capacity Charge	$119,806.45
Energy Charge	$329,178.49
Total Capacity and Energy	$448,984.94
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$448,984.94

Date: June 1990

TOTAL ENERGY - KWH	12,884,400
BILLING CAPACITY - KVA	31,808

CAPACITY CHARGE

(200) First	200	KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next	400	KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional	31,208	KVA of Billing Capacity @ $4.05 =	$126,392.40
TOTAL KVA	31,808		$128,982.40
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =		($6,361.60)
			$122,620.80

ENERGY CHARGE

50 x 31808 =	1,590,400 KWH	@ 0.03726 =	$59,258.30
100 x 31808 =	3,180,800 KWH	@ 0.03206 =	$101,976.45
250 x 31808 =	7,952,000 KWH	@ 0.02886 =	$229,494.72
EXCESS =	161,200 KWH	@ 0.02666 =	$4,297.59
TOTAL KVA	12,884,400		$395,027.06

Capacity Charge	$122,620.80
Energy Charge	$395,027.06
Total Capacity and Energy	$517,647.86
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$517,647.86

Date: July 1990

TOTAL ENERGY - KWH	17,886,400
BILLING CAPACITY - KVA	34,177

CAPACITY CHARGE

(200) First	200 KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next	400 KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional	33,577 KVA of Billing Capacity @ $4.05 =	$135,986.85
TOTAL KVA	34,177	$138,576.85
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =	($6,835.40)
		$131,741.45

ENERGY CHARGE

50 x	34177 =	1,708,850 KWH @ 0.03726 =	$63,671.75
100 x	34177 =	3,417,700 KWH @ 0.03206 =	$109,571.46
250 x	34177 =	8,544,250 KWH @ 0.02886 =	$246,587.06
EXCESS	=	4,215,600 KWH @ 0.02666 =	$112,387.90
TOTAL KVA		17,886,400	$532,218.16

Capacity Charge	$131,741.45
Energy Charge	$532,218.16
Total Capacity and Energy	$663,959.61
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$663,959.61

Date: August 1990

TOTAL ENERGY - KWH	13,445,200
BILLING CAPACITY - KVA	30,176

CAPACITY CHARGE		
(200) First	200 KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next	400 KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional	29,576 KVA of Billing Capacity @ $4.05 =	$119,782.80
TOTAL KVA	30,176	$122,372.80
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =	($6,035.20)
		$116,337.60

ENERGY CHARGE			
50 x	30176 =	1,508,800 KWH @ 0.03726 =	$56,217.89
100 x	30176 =	3,017,600 KWH @ 0.03206 =	$96,744.26
250 x	30176 =	7,544,000 KWH @ 0.02886 =	$217,719.84
EXCESS	=	1,374,800 KWH @ 0.02666 =	$36,652.17
TOTAL KVA		13,445,200	$407,334.15

Capacity Charge	$116,337.60
Energy Charge	$407,334.15
Total Capacity and Energy	$523,671.75
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$523,671.75

Date: September 1990

TOTAL ENERGY - KWH	17,998,800
BILLING CAPACITY - KVA	33,819

CAPACITY CHARGE			
(200) First	200 KVA of Billing Capacity @ $4.45 =		$890.00
(400) Next	400 KVA of Billing Capacity @ $4.25 =		$1,700.00
Additional	33,219 KVA of Billing Capacity @ $4.05 =		$134,536.95
TOTAL KVA	33,819		$137,126.95
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =		($6,763.80)
			$130,363.15
ENERGY CHARGE			
50 x 33819 =	1,690,950 KWH @ 0.03726 =	$63,004.80	
100 x 33819 =	3,381,900 KWH @ 0.03206 =	$108,423.71	
250 x 33819 =	8,454,750 KWH @ 0.02886 =	$244,004.09	
EXCESS =	4,471,200 KWH @ 0.02666 =	$119,202.19	
TOTAL KVA	17,998,800	$534,634.79	

Capacity Charge	$130,363.15
Energy Charge	$534,634.79
Total Capacity and Energy	$664,997.94
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$664,997.94

Date: October 1990

TOTAL ENERGY - KWH	12,267,600		
BILLING CAPACITY - KVA	27,341		
CAPACITY CHARGE			
(200) First		200 KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next		400 KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional		26,741 KVA of Billing Capacity @ $4.05 =	$108,301.05
TOTAL KVA	27,341		$110,891.05
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =		($5,468.20)
			$105,422.85

ENERGY CHARGE			
50 x 27341 =	1,367,050 KWH @ 0.03726 =	$50,936.28	
100 x 27341 =	2,734,100 KWH @ 0.03206 =	$87,655.25	
250 x 27341 =	6,835,250 KWH @ 0.02886 =	$197,265.32	
EXCESS =	1,331,200 KWH @ 0.02666 =	$35,489.79	
TOTAL KVA	12,267,600	$371,346.64	

Capacity Charge	$105,422.85
Energy Charge	$371,346.64
Total Capacity and Energy	$476,769.49
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$476,769.49

Date: November 1990

TOTAL ENERGY - KWH	11,930,400
BILLING CAPACITY - KVA	27,341

CAPACITY CHARGE

(200) First	200	KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next	400	KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional	26,741	KVA of Billing Capacity @ $4.05 =	$108,301.05
TOTAL KVA	27,341		$110,891.05
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =		($5,468.20)
			$105,422.85

ENERGY CHARGE

50 x	27341 =	1,367,050	KWH @ 0.03726 =	$50,936.28
100 x	27341 =	2,734,100	KWH @ 0.03206 =	$87,655.25
250 x	27341 =	6,835,250	KWH @ 0.02886 =	$197,265.32
EXCESS	=	994,000	KWH @ 0.02666 =	$26,500.04
TOTAL KVA		11,930,400		$362,356.88

Capacity Charge	$105,422.85
Energy Charge	$362,356.88
Total Capacity and Energy	$467,779.73
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$467,779.73

Date: December 1990

TOTAL ENERGY - KWH	14,032,800		
BILLING CAPACITY - KVA	29,209		

CAPACITY CHARGE			
(200) First	200 KVA of Billing Capacity @ $4.45 =		$890.00
(400) Next	400 KVA of Billing Capacity @ $4.25 =		$1,700.00
Additional	28,609 KVA of Billing Capacity @ $4.05 =		$115,866.45
TOTAL KVA	29,209		$118,456.45
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =		($5,841.80)
			$112,614.65
ENERGY CHARGE			
50 x 29209 =	1,460,450 KWH @ 0.03726 =	$54,416.37	
100 x 29209 =	2,920,900 KWH @ 0.03206 =	$93,644.05	
250 x 29209 =	7,302,250 KWH @ 0.02886 =	$210,742.94	
EXCESS =	2,349,200 KWH @ 0.02666 =	$62,629.67	
TOTAL KVA	14,032,800	$421,433.03	

Capacity Charge	$112,614.65
Energy Charge	$421,433.03
Total Capacity and Energy	$534,047.68
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$534,047.68

Date: January 1991

TOTAL ENERGY - KWH	13,314,000
BILLING CAPACITY - KVA	27,341

CAPACITY CHARGE

(200) First	200 KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next	400 KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional	26,741 KVA of Billing Capacity @ $4.05 =	$108,301.05
TOTAL KVA	27,341	$110,891.05
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =	($5,468.20)
		$105,422.85

ENERGY CHARGE

50 x	27341 =	1,367,050 KWH @ 0.03726 =	$50,936.28
100 x	27341 =	2,734,100 KWH @ 0.03206 =	$87,655.25
250 x	27341 =	6,835,250 KWH @ 0.02886 =	$197,265.32
EXCESS	=	2,377,600 KWH @ 0.02666 =	$63,386.82
TOTAL KVA		13,314,000	$399,243.66

Capacity Charge	$105,422.85
Energy Charge	$399,243.66
Total Capacity and Energy	$504,666.51
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$504,666.51

Date: February 1991

TOTAL ENERGY - KWH	10,196,000
BILLING CAPACITY - KVA	27,341

CAPACITY CHARGE		
(200) First	200 KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next	400 KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional	26,741 KVA of Billing Capacity @ $4.05 =	$108,301.05
TOTAL KVA	27,341	$110,891.05
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =	($5,468.20)
		$105,422.85

ENERGY CHARGE				
50 x	27341 =	1,367,050 KWH @ 0.03726 =		$50,936.28
100 x	27341 =	2,734,100 KWH @ 0.03206 =		$87,655.25
250 x	=	6,094,850 KWH @ 0.02886 =		$175,897.37
EXCESS	=	0 KWH @ 0.02666 =		$0.00
TOTAL KVA		10,196,000		$314,488.90

Capacity Charge	$105,422.85
Energy Charge	$314,488.90
Total Capacity and Energy	$419,911.75
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$419,911.75

Date: March 1991

TOTAL ENERGY - KWH	10,618,800
BILLING CAPACITY - KVA	27,341

CAPACITY CHARGE			
(200) First	200 KVA of Billing Capacity @ $4.45 =		$890.00
(400) Next	400 KVA of Billing Capacity @ $4.25 =		$1,700.00
Additional	26,741 KVA of Billing Capacity @ $4.05 =		$108,301.05
TOTAL KVA	27,341		$110,891.05
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =		($5,468.20)
			$105,422.85
ENERGY CHARGE			
50 x 27341 =	1,367,050 KWH @ 0.03726 =	$50,936.28	
100 x 27341 =	2,734,100 KWH @ 0.03206 =	$87,655.25	
250 x =	6,517,650 KWH @ 0.02886 =	$188,099.38	
EXCESS =	0 KWH @ 0.02666 =	$0.00	
TOTAL KVA	10,618,800	$326,690.91	

Capacity Charge	$105,422.85
Energy Charge	$326,690.91
Total Capacity and Energy	$432,113.76
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$432,113.76

Date: April 1991

TOTAL ENERGY - KWH	9,345,600		
BILLING CAPACITY - KVA	27,341		

CAPACITY CHARGE			
(200) First	200	KVA of Billing Capacity @ $4.45 =	$890.00
(400) Next	400	KVA of Billing Capacity @ $4.25 =	$1,700.00
Additional	26,741	KVA of Billing Capacity @ $4.05 =	$108,301.05
TOTAL KVA	27,341		$110,891.05
Ownership (Y/N)? Y	Less Substation Ownership Discount @ $.20/KVA =		($5,468.20)
			$105,422.85

ENERGY CHARGE			
50 x 27341 =	1,367,050	KWH @ 0.03726 =	$50,936.28
100 x 27341 =	2,734,100	KWH @ 0.03206 =	$87,655.25
250 x =	5,244,450	KWH @ 0.02886 =	$151,354.83
EXCESS =	0	KWH @ 0.02666 =	$0.00
TOTAL KVA	9,345,600		$289,946.36

Capacity Charge	$105,422.85
Energy Charge	$289,946.36
Total Capacity and Energy	$395,369.21
Subtotal	$0.00
City Revenue Charge	$0.00
Subtotal	$0.00
KRST Exempt 100.00%	$0.00
LRST Exempt 100.00%	$0.00
Subtotal	$0.00
Other Charges	$0.00
TOTAL AMOUNT DUE	$395,369.21

APPENDIX

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 2-6-91
CHECKED BY RDF DATE ______
JOB NO. 5080

BUILDING COEFFICIENTS & DESIGN CONDITIONS

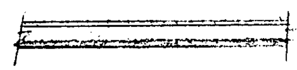
ENERGY PLANT

DESIGN CONDITIONS

WINTER	INSIDE	68°F
	OUTSIDE	-10°F

ROOF

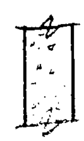
INSIDE AIR FILM	0.61
1½" STEEL DECK	0.0
2" RIGID INSUL	8.0
SINGLE PLY ROOFING	0.15
OUTSIDE AIR FILM	0.17
	8.93



$U = 1/R = 0.11$

WALL

OUTSIDE AIR FILM	0.17
8" POURED CONCRETE	1.12
INSIDE AIR FILM	0.68
	1.97



$U = 1/R = 0.51$

GLASS

SINGLE PANE CLEAR $U = 1.1$

$SC = 0.95$

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ________ OF ________
CALCULATED BY MHM DATE 2-6-91
CHECKED BY RDF DATE ________
JOB NO. 5080

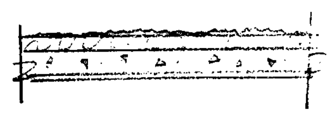
NURSE QUARTERS BLDG 610

DESIGN CRITERIA

SUMMER	INSIDE	78°F 50% RH	REFER: TM5-785 AND A+E INSTRUCTION
	OUTSIDE	99°F dB 75°F wb	
WINTER	INSIDE	68°F	
	OUTSIDE	-1°F	

ROOF

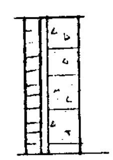
INSIDE AIR FILM	= 0.61
HARD CEILING TILE	= 0.32
8" CONCRETE DECK	= 0.64
2" INSULATION	= 6.0
5 PLY BUILT-UP ROOF	= 0.33
OUTSIDE AIR FILM	= 0.17
	8.07



$U = 1/R = 0.12$

WALL

INSIDE AIR FILM	= 0.68
8" CONC BLOCK	= 0.88
1/2" AIRSPACE	= 2.4
4" FACEBRICK	= 0.44
OUTSIDE AIR FILM	= 0.17
	4.57



$U = 1/R = 0.21$

GLASS

1/4" CLEAR DOUBLE HUNG ALUMINUM FRAME WITH
1/4" CLEAR GLASS STORM WINDOWS
$U = 0.57$ $SC = 0.83$

JOB Irwin EEAP - Ft. Riley, Kansas

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

SHEET NO. OF

CALCULATED BY MHM DATE 2-6-91

CHECKED BY RDF DATE

JOB NO. 5080

NURSE QUARTERS - cont

INFILTRATION

WINDOWS 0.5 CFM PER LINEAL FOOT OF CRACK } REFER: 1981

DOORS 1.0 CFM PER LINEAL FOOT OF CRACK } ASHRAE FUND 22.10

VENTILATION

MINIMUM = 15 CFM PER PERSON PER ASHRAE STANDARD 62

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

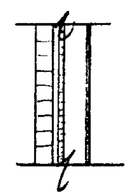
JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 2-6-91
CHECKED BY RDF DATE ______
JOB NO. 5080

BARRACKS - BLDG 620 & 621

DESIGN CONDITIONS

SUMMER	INSIDE	78°F 50% RH	REFER: TM5-785 AND A&E INSTRUCTIONS
	OUTSIDE	99°F db 75°F wb	
WINTER	INSIDE	68°F	
	OUTSIDE	-1°F	

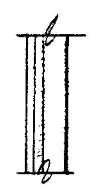
WALL - 1ST FLOOR



OUTSIDE AIR	= 0.17
4" BRICK	= 0.44
1" AIR SPACE	= 1.0
3/4" INSUL	= 2.75
2x4 STUDS	= 0
1/2" GYP BOARD	= 0.45
INSIDE AIR FILM	= 0.68
	5.49

$U = 1/R = 0.18$

WALL - 2ND FLOOR



OUTSIDE AIR FILM	= 0.17
3/4" WOOD BATTEN & BOARD	= 0.81
3/4" INSULATION	= 2.25
2x4 STUDS	= 0
1/2 GYP BOARD	= 0.45
INSIDE AIR FILM	= 0.68
	4.36

$U = 1/R = 0.23$

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

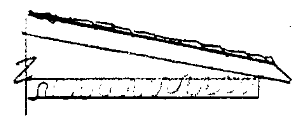
JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 2-6-91
CHECKED BY RDF DATE ______
JOB NO. 5080

BARRACKS cont

ROOF

OUTSIDE AIR FILM	= 0.17
SHINGLES	= 0.44
FELT	= 0.06
3/4" PLYWOOD SHEATHING	= 0.59
3" BATT INSUL	= 11.0
1/2" GYP BOARD	= 0.45
INSIDE AIR FILM	= 0.61
	13.32

$U = 1/R = 0.075$



GLASS

SINGLE PANE CLEAR DOUBLE HUNG IN ALUMINUM FRAME WITH SINGLE PANE CLEAR STORMS. $U = 0.57$ $SC = 0.83$

INFILTRATION

WINDOWS 0.5 CFM PER LINEAL FOOT OF CRACK
DOORS 1.0 CFM PER LINEAL FOOT OF CRACK
REFER: 1981 ASHRAE FUND CH 22.10

VENTILATION

MINIMUM = 15 CFM PER PERSON
ACTUAL = 75 CFM PER PERSON

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

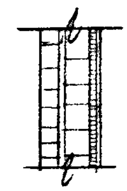
JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 2-6-91
CHECKED BY RDF DATE ______
JOB NO. 5080

1955 HOSPITAL BLDG 600

DESIGN CRITERIA

SUMMER	INSIDE	68°F, 75°F, 78°F : 50% RH	REFER: TM5-785 AND TM5-838-2
	OUTSIDE	99°F db 75°F wb	
WINTER	INSIDE	68°F, 70°F, 75°F	
	OUTSIDE	-1°F	

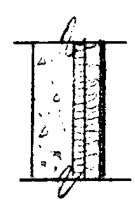
WALL A TYPICAL BRICK



OUTSIDE AIR FILM	= 0.17
4" FACE BRICK	= 0.44
3/4" VOID (GROUT FILLED)	= 0.08
4" CMU	= 0.71
3/4 RIGID INSUL	= 2.0
1/2" GYP	= 0.45
INSIDE AIR FILM	= 0.68
	4.53

$U = 1/R = 0.22$

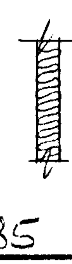
WALL B TYPICAL CONCRETE



OUTSIDE AIR FILM	= 0.17
13" REINF CONC	= 1.04
2" RIGID INSUL	= 6.0
3" STUD	= 0.0
1" PLASTER	= 0.2
INSIDE AIRSPACE	= 0.68
	8.09

$U = 1/R = 0.12$

WALL C METAL PENTHOUSES



OUTSIDE AIR FILM	= 0.17
3" INSUL METAL PANEL	= 11.0
INSIDE AIR FILM	= 0.68
	= 11.85

$U = 1/R = 0.085$

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas

SHEET NO. ______ OF ______

CALCULATED BY MHM DATE 2-6-91

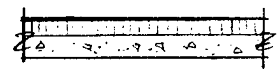
CHECKED BY RDF DATE ______

JOB NO. 5080

1955 HOSPITAL cont

ROOF - HOSPITAL (installed 1986)

OUTSIDE AIR FILM	= 0.17
TAPER TILE EPS 2½"	= 10.6
2¼" ISOCYANURATE	= 14.0
4 CONC DECK	= 0.44
INSIDE AIR FILM	= 0.61
	25.82



$U = 1/R = 0.039$

ROOF - PENTHOUSE

OUTSIDE AIR FILM	= 0.17
SINGLE PLY BALLASTED ROOF	= 0.33
2" RIGID INSUL	= 8.0
1½" STEEL DECK	= 0.0
INSIDE AIR SPACE	= 0.61
	9.11

$U = 1/R = 0.11$

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. OF
CALCULATED BY MHM DATE 2-6-91
CHECKED BY RDF DATE
JOB NO. 5080

1955 HOSPITAL cont.

SPANDREL WALL D

OUTSIDE AIR FILM	=	0.17
1/4" GLASS	=	0.9
2" RIGID POLYURETHENE	=	10.0
CRAFT PAPER	=	0.0
METAL PANEL	=	0.0
INSIDE AIR FILM	=	0.68
		11.75

$U = 1/R = 0.085$

GLASS E

DOUBLE PANE BRONZE REFLECTIVE $U = 0.57$ $SC = 0.4$
1/4", 1 3/4", 1/4"

INFILTRATION

WINDOWS 0.5 CFM. PER LINEAL FT OF CRACK
DOOR 1.0 CFM PER LINEAL FT OF CRACK
REFER: 1981 ASHRAE FUND CH 22.10

VENTILATION

MINIMUM BASED ON TM 5-838-2

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

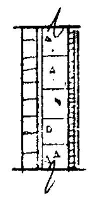
JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 2-6-91
CHECKED BY EDF DATE ______
JOB NO. 5080

1975 HOSPITAL ADDITION

DESIGN CONDITIONS

SUMMER	INSIDE	78°FdB, 75°FdB, 68°FdB : 50% RH	REFER: TM 5-785 AND TM5-838-2
	OUTSIDE	99°FdB 75°Fwb	
WINTER	INSIDE	68°FdB, 70°F, 75°F	
	OUTSIDE	-1°F	

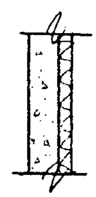
WALL F - TYPICAL BRICK WALL



OUTSIDE AIR FILM	= 0.17
4" FACE BRICK	= 0.44
1" SPACE WITH GROUT	= 0.11
8" CMU	= 1.72
1" RIGID INSUL	= 4.0
1/2" GYP BOARD	= 0.45
INSIDE AIR FILM	= 0.68
	7.57

$U = 1/R = 0.13$

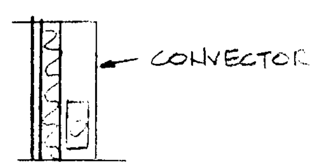
WALL G - TYPICAL CONCRETE PANEL



OUTSIDE AIR FILM	= 0.17
5" PRECAST CONCRETE	= 0.65
1 1/2" RIGID INSULATION	= 6.0
INSIDE AIR FILM	= 0.65
	7.5

$U = 1/R = 0.13$

WALL H - SPANDREL



OUTSIDE AIR FILM	= 0.17
1" INSUL GLASS	= 1.78
3" BATT INSUL	= 11.0
METAL PANEL	= 0
INSIDE AIR FILM	= 0.68
	13.63

$U = 1/R = 0.073$

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

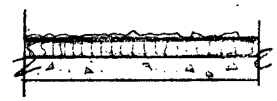
JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 2-6-91
CHECKED BY RDF DATE ______
JOB NO. 5080

1975 HOSPITAL - cont

ROOF REPLACED ROOF IN 1985

OUTSIDE AIR FILM	= 0.17
TAPER TILE EPS 2½"	= 10.6
2¼ ISOCYANURATE	= 14.0
4" CONC DECK	= 0.44
INSIDE AIR FILM	= 0.61
	25.82

$U = 1/R = 0.039$



GLASS I

1" DOUBLE PANE BRONZE TINTED

U = 0.57 SC = 0.55

INFILTRATION

WINDOWS 0.5 CFM/LF OF CRACK
DOORS 1.0 CFM/LF OF CRACK

} REFER: 1981 ASHRAE FUND. 22.10

VENTILATION

MINIMUM BASED ON TM 5-838-2

ROOF ORIGINAL ROOF

OUTSIDE AIR FILM	= 0.17
SINGLE PLY BALLASTED	= 0.15
3" POLYURETHANE	= 16.5
5" CONC DECK	= 0.55
INSIDE AIR FILM	= 0.61
	17.98

$U = 1/R = 0.055$

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas

SHEET NO. ____ OF ____

CALCULATED BY MHM DATE 2-15-91

CHECKED BY RDF DATE ____

JOB NO. 5080

OCCUPANCY SCHEDULES

THE FOLLOWING SCHEDULES ARE USED IN THE "TRACE 600" PROGRAM. SCHEDULES ARE INPUT AS A PERCENT OF MAXIMUM LOAD FOR EACH HOUR. SCHEDULES ARE BASED ON INFORMATION PROVIDED BY THE LOGISTICS DEPARTMENT AND THROUGH PERSONNEL INTERVIEWS DURING THE SURVEY.

HOUR		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
BARRACKS																									
	LIGHTS	50	50	50	50	50	50	50	50	30	30	30	30	30	30	30	30	50	50	50	50	50	50	50	50
MON-SUN	PEOPLE	30	→																						
	MISC	30	→																						
KITCHEN & DINE																									
	LIGHTS	0	0	0	0	100	→														0	0	0	0	0
MON-SUN	PEOPLE	0	0	0	0	100	→														0	0	0	0	0
	MISC	0	0	0	0	50	50	100	→										30	30	0	0	0	0	0
CORE AREAS																									
MON-SUN	LIGHTS	100	→																						
	PEOPLE	100	→																						
ADMISSIONS & DISPOSITIONS																									
	LIGHTS	100	→																						
MON-SUN	PEOPLE	50	50	50	50	50	50	50	50	100	100	100	100	100	100	100	100	50	50	50	50	50	50	50	50
	MISC	50	50	50	50	50	50	50	50	100	100	100	100	100	100	100	100	50	50	50	50	50	50	50	50

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas

SHEET NO. ______ OF ______

CALCULATED BY MHM DATE 2-15-91

CHECKED BY RDF DATE ______

JOB NO. 5080

OCCUPANCY SCHEDULES cont

HOUR		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
EMERGENCY																									
MON-SUN	PEOPLE	100 ———																							
	LIGHTS	100 ———																							
	MISC	100 ———																							
O.R. & RECOVERY																									
	PEOPLE	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	15	15	15	15	15	15	15	15
MON-SUN	LIGHTS	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	50	50	50	50	50	50	50	50
	MISC	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	30	30	30	30	30	30	30	30
LABOR & DELIVERY																									
	PEOPLE	100 ———																							
MON-SUN	LIGHTS	30	30	30	30	30	30	30	100 ———→														30	30	30
	MISC	50	50	50	50	50	50	50	100 ———→									50	50	50	50	50	50	50	50
PATIENT WINGS																									
MON-SUN	PEOPLE	100 ———																							
	LIGHTS	30	30	30	30	30	30	30	100	100	100	100	100	100	100	100	100	100	100	100	100	100	30	30	30
	MISC	50	50	50	50	50	50	50	100 ———→														50	50	50
MORGUE																									
MON-SUN	PEOPLE	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0
	LIGHTS	50	50	50	50	50	50	50	100	100	100	100	100	100	100	100	100	50	50	50	50	50	50	50	50
	MISC	100 ———																							

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. OF
CALCULATED BY MHM DATE 2-15-91
CHECKED BY RDF DATE
JOB NO. 5080

OCCUPANCY SCHEDULES cont

HOUR			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DENTAL SURGERY & CLINIC	MON-FRI	PEOPLE	0	—	—	—	—	—	—	100	100	100	100	100	100	100	100	100	0	—	—	—	—	—	—	—
		LIGHTS	0	—	—	—	—	—	—	100	100	100	100	100	100	100	100	100	0	—	—	—	—	—	—	—
		MISC	0	—	—	—	—	—	—	100	100	100	100	100	100	100	100	100	0	—	—	—	—	—	—	—
ADMIN, CLINICS & RECORDS.		PEOPLE	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0
		LIGHTS	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0
		MISC	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0
X-RAY	MON-SUN	PEOPLE	10	10	10	10	10	10	10	100	100	100	100	100	100	100	100	100	10	10	10	10	10	10	10	10
		LIGHTS	40	40	40	40	40	40	40	100	100	100	100	100	100	100	100	100	40	40	40	40	40	40	40	40
		MISC	25	25	25	25	25	25	25	100	100	100	100	100	100	100	100	100	25	25	25	25	25	25	25	25
HOUSEKEEPING	MON-FRI	PEOPLE	0	0	0	0	0	0	0	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
		LIGHTS	0	0	0	0	0	0	0	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
		MISC	0	0	0	0	0	0	0	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
PHARMACY	MON-FRI	PEOPLE	0	0	0	0	0	0	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	0
		LIGHTS	0	0	0	0	0	0	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	0
		MISC	0	0	0	0	0	0	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	0
	SAT-SUN	PEOPLE	0	0	0	0	0	0	0	0	17	17	17	17	17	17	17	17	0	0	0	0	0	0	0	0
		LIGHTS	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0
		MISC	0	0	0	0	0	0	0	0	17	17	17	17	17	17	17	17	0	0	0	0	0	0	0	0

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas

SHEET NO. ________ OF ________

CALCULATED BY MHM DATE 2-15-91

CHECKED BY RDF DATE ________

JOB NO. 5080

OCCUPANCY SCHEDULES cont.

HOUR		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
LAB		
MON-FRI	PEOPLE	0 0 0 0 0 0 0 100 ——— 0 0 0 0 0 0 0 0
	LIGHTS	100 ———
	MISC	50 50 50 50 50 50 50 100 ——— 50 50 50 50 50 50 50 50
SAT-SUN	PEOPLE	10 ———
	LIGHTS	100 ———
	MISC	50 ———

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. OF
CALCULATED BY MHM DATE 3-8-91
CHECKED BY RDF DATE
JOB NO. 5080

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CONSULTING ENGINEERS

ENERGY USE PROFILE

INFORMATION IS TAKEN FROM TEST & BALANCE REPORTS, AN EQUIPMENT LIST PROVIDED BY THE HOSPITAL, AND RECORD DRAWINGS.

ELECTRICAL - 1955 HOSPITAL

① SUPPLY FANS

		KWH
B2-1	2×30HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 24 HR/DAY	= 274,470
B2-2	2×20HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 24 HR/DAY	= 132,930
B2-3	1×10HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 12 HR/DAY	= 26,140
B6-1	2×25HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 24 HR/DAY	= 223,725
B6-2	2×15HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 24 HR/DAY	= 156,840
A6-1	2×40HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 24 HR/DAY	= 365,960
A6-2	2×30HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 24 HR/DAY	= 274,470
C4-1	2×20HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 24 HR/DAY	= 209,120
C4-2	2×15HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 24 HR/DAY	= 156,840
CB-1	2×15HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 24 HR/DAY	= 137,235
P7-1	1×5HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 24 HR/DAY	= 26,140
BN22	1×1.5HP × 0.746 KW/HP × 0.8LF × 260 DAY/YR × 9 HR/DAY	= 2,100
S-6	1×1.5HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 24 HR/DAY	= 7,840
	TOTAL	2,043,360

② RETURN FANS

B2-1	1×7.5HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 16 HR/DAY	= 22,870
B2-2	1×3HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 16 HR/DAY	= 9,150
B6-1	1×5HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 16 HR/DAY	= 15,250
B6-2	2×3HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 16 HR/DAY	= 20,910
A6-1	1×15HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 16 HR/DAY	= 45,750
A6-2	1×15HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 16 HR/DAY	= 45,750
C4-1	1×5HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 16 HR/DAY	= 17,430
C4-2	1×5HP × 0.746 KW/HP × 0.8LF × 365 DAY/YR × 16 HR/DAY	= 17,430
CB-1	1×5HP × 0.746 KW/HP × 0.7LF × 365 DAY/YR × 16 HR/DAY	= 15,250
	TOTAL	= 209,790

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MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas

SHEET NO. ______ OF ______

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CHECKED BY BDF DATE ______

JOB NO. 5080

(3) EXHAUST FANS

			KWH
EF-1	1/4 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	1,305
EF-2	1/4 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	1,305
EF-3	1 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	5,230
EF-4	20 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 16 HR/DAY	=	69,710
EF-5	2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 16 HR/DAY	=	6,970
EF-6	1/2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	2,615
EF-7	1/4 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	1,305
EF-8	2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	3,440
EF-9	2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	3,440
EF-10	1/2 HP × 0.746 KW/HP × 0.8 LF × 0 FOR 1990	=	0
EF-11	2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	3,440
EF-12	1 1/2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	2,580
EF-13	1 1/2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	2,580
EF-14	5 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	8,590
EF-15	5 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	8,590
EF-16	5 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	8,590
EF-17	1/2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	860
EF-18	1/4 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	430
EF-19	1/3 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	1,725
EF-20	3/4 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	3,920
EF-21	1 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	5,230
EF-22	1/2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	2,610
EF-23	1/4 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	1,305
EF-24	1 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	1,720
EF-25	1 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	1,720
EF-26	1 1/2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	7,840
EF-27	1/2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	2,610
EF-28	3/4 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY	=	1,290
EF-29	DELETED		
EF-30	1 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	5,230

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MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB	Irwin EEAP - Ft. Riley, Kansas		
SHEET NO.		OF	
CALCULATED BY	MHM	DATE	3-8-91
CHECKED BY	RDF	DATE	
JOB NO.	5080		

KWH

③ EXHAUST FANS (cont)

		KWH
EF-31	3/4 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY =	1290
EF-32	3/4 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY =	1290
EF-33	1/3 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 16 HR/DAY =	565
	TOTAL =	169,325

④ PUMPS

CONDENSATE	2 × 3/4 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 8 HR/DAY =	2,620
P14 + P15	5 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	26,140
CONDENSATE	7.5 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 8 HR/DAY =	13,070
DOMESTIC HW	3/4 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	3,920
DOMESTIC HW	1/4 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	1,305
P18 + P19	5 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	26,140
CONDENSATE	1/2 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 8 HR/DAY =	870
P-20 + P-21	5 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	26,140
P-16 + P-17	5 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	26,140
		TOTAL	126,345

⑤ STAIRWELL PRESSURIZATION FANS

STAIR	1	3 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	15,680
	2	2 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	10,460
	3	1 1/2 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	7,840
	4	3/4 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	3,920
	5	1/3 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	1,730
	A	1/3 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	1,730
	E	2 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	10,460
	F	1 HP	× 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY =	5,230
			TOTAL	57,050

JOB	Irwin EEAP - Ft. Riley, Kansas
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MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

KWH

(6) AIR COMPRESSORS & VACCUUM PUMPS

AIR DRYER	3/4 HP x 0.746 KW/HP x 0.8LF x 365 DAY/YR x 8 HR/DAY =	1,305
DENTAL AC	7.5 HP x 0.746 KW/HP x 0.8LF x 260 DAY/YR x 8 HR/DAY =	9,310
DENTAL AIR DRYER	3/4HP x 0.746 KW/HP x 0.8LF x 260 DAY/YR x 8 HR/DAY =	930
CONTROL AIR	25 HP x 0.746 KW/HP x 0.8LF x 365 DAY/YR x 5 HR/DAY =	43,570
B-10 AIR COMP.	25 HP x 0.746 KW/HP x 0.8LF x 365 DAY/YR x 8 HR/DAY =	43,570
	TOTAL	98,685

(7) MISC EQUIPMENT
210 KW x 16 HR/DAY x 365 DAY/YR = 1,226,400

(8) ELEVATORS

ELEV 1	30 HP x 0.746 KW/HP x 0.8LF x 365 DAY/YR x 6 HR/DAY =	39,210
3	30 HP x 0.746 KW/HP x 0.8LF x 365 DAY/YR x 6 HR/DAY	39,210
4	30 HP x 0.746 KW/HP x 0.8LF x 365 DAY/YR x 6 HR/DAY	39,210
5	30 HP x 0.746 KW/HP x 0.8LF x 365 DAY/YR x 6 HR/DAY	39,210
	TOTAL	156,840

(9) KITCHEN EQUIP
365 KW x 16 HR/DAY x 365 DAY/YR x 0.5 DIVERSITY = 1,065,800

MNB
MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

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ELECTRICAL - 1975 HOSPITAL

KWH

(10) SUPPLY FANS

			KWH
S-1	50 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	261,400
S-2	40 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	209,120
S-3	50 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	261,400
S-4	50 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	261,400
S-5	50 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	261,400
S-7	30 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	156,840
	TOTAL		1,411,560

(11) RETURN FANS

RE-1	15 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	78,420
RE-2	10 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY		52,280
RE-3	15 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY		78,420
RE-4	10 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY		52,280
RE-5	7.5 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY		39,210
	TOTAL		300,610

(12) EXHAUST FANS

TE-1	1.5 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	7,840
TE-2	2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	10,460
TE-3	2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	10,460
GE-1	1.5 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	7,840
GE-2	3/4 HP × 0.746 KW/HR × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	3,920
GE-3	3 HP × 0.746 KW/HR × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	15,630
E-4	1 HP × 0.746 KW/HR × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	5,230
E-6	2 HP × 0.746 KW/HR × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	10,460
E-7	2 HP × 0.746 KW/HR × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	10,460
E-1	10 HP × 0.746 KW/HR × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	52,280
	TOTAL		134,630

JOB	Irwin EEAP - Ft. Riley, Kansas
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MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

KWH

(13) AIR COMPRESSORS

CONTROL 7.5 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 8 HR/DAY = 13,070

CONTROL 7.5 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 8 HR/DAY = 13,070

TOTAL 26,140

(14) MISC EQUIPMENT

200 KW x 16 HR/DAY x 365 DAY/YR = 1,168,000

(15) ELEVATORS

ELEV 6 30 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 6 HR/DAY = 39,210

7 30 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 6 HR/DAY = 39,210

TOTAL 78,42[illegible]

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JOB Irwin EEAP - Ft. Riley, Kansas
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KWH

ELECTRICAL - ENERGY PLANT

(16) PUMPS

DEAERATOR	1 x 30 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 8 HR/DAY	= 52,280
TRANSFER	1 x 7.5 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 8 HR/DAY	= 13,070
CONDENSATE	1 x 1 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 8 HR/DAY	= 1,740
P-1	10 HP x 0.746 KW/HP x 0.8 LF x 30 DAY/YR x 24 HR/DAY	= 4,295
P-2	10 HP x 0.746 KW/HP x 0.8 LF x 0 HR/DAY	= 0
P-3	10 HP x 0.746 KW/HP x 0.8 LF x 0 HR/DAY	= 0
P-4	15 HP x 0.746 KW/HP x 0.8 LF x 90 DAY/YR x 24 HR/DAY	= 19,335
P-5	STANDBY	
P-6	15 HP x 0.746 KW/HP x 0.8 LF x 30 DAY/YR x 24 HR/DAY	= 6,450
P-7	75 HP x 0.746 KW/HP x 0.8 LF x 0.7 LF x 365 DAY/YR x 24 HR/DAY	= 274,470
P-8	STANDBY	
P-9	50 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 24 HR/DAY	= 261,400
CTWP-1	50 HP x 0.746 KW/HP x 0.8 LF x 365 DAY/YR x 24 HR/DAY	= 261,400
CTWP-2	50 HP x 0.746 KW/HP x 0.8 LF x 90 DAY/YR x 24 HR/DAY	= 64,455
CTWP-3	STANDBY	
CTWP-4	50 HP x 0.746 KW/HR x 0.8 LF x 30 DAY/YR x 24 HR/DAY	= 21,485
CTWP-5	50 HP x 0.746 KW/HR x 0.8 LF x 30 DAY/YR x 24 HR/DAY	= 21,485
CTWP-6	50 HP x 0.746 KW/HR x 0.8 LF x 0	= 0
SUMP PUMP	1/2 HP x 0.746 KW/HP x 0.8 LF x 180 DAY/YR x 2 HR/DAY	= 110
	TOTAL	1,001,975

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MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

KWH

(17) FANS

BOILER ID	15 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	= 78,420
BOILER ID	15 HP × 0.746 KW/HP × 0.8 LF × 150 DAY/YR × 24 HR/DAY	= 32,230
BOILER FD	15 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	= 78,420
BOILER FD	15 HP × 0.746 KW/HP × 0.8 LF × 150 DAY/YR × 24 HR/DAY	= 32,230
CLG TOWER	3 × 20 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 8 HR/DAY	= 51,560
CLG TOWER	4 × 25 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 8 HR/DAY	= 85,940
	TOTAL	358,800

(18) CHILLERS - SPACE COOLING BLDG 600 = 1,677,295
BASED ON "TRACE 600" SYSTEM PROFILE

(19) LIGHTING - ENTIRE HOSPITAL
FROM "TRACE 600" EQUIPMENT OUTPUT = 1,926,760

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ELECTRICAL - BLDG 610, 620, 621 KWH

(20) MISC POWER
47 KW × 365 DAY/YR × 0.5 DIVERSITY × 24 HR/DAY = 205,860

(21) LIGHTING
94 KW × 0.4 DIVERSITY × 24 HR/DAY × 365 DAY/YR = 329,375

(22) FANS

FAN COIL UNITS	72 × 1/10 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 24 HR/DAY	=	18,560
EXHAUST FANS	5 × 1/10 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	2,615
VENT FANS	4 × 2 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 24 HR/DAY	=	41,825
	TOTAL	=	63,000

(23) PUMPS

HOT WATER	2 × 3/4 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 24 HR/DAY	=	3870
HOT WATER	2 × 1 1/2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 24 HR/DAY	=	7735
CONDENSATE	1 × 1 1/2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 8 HR/DAY	=	1290
CONDENSATE	2 × 1/2 HP × 0.746 KW/HP × 0.8 LF × 180 DAY/YR × 8 HR/DAY	=	860
EJECTOR	2 × 3/4 HP × 0.746 KW/HP × 0.8 LF × 365 DAY/YR × 2 HR/DAY	=	655
CHW PUMP	2 HP × 0.746 KW/HP × 0.8 LF × 150 DAY/YR × 24 HR/DAY	=	4300
	TOTAL		18,710

(24) SPACE COOLING - BLDG 620 & 621
WINDOW UNITS 24 × 1.95 KW × 150 DAY/YR × 24 HR/DAY = 168,480

(25) SPACE COOLING - BLDG 610
AIR COOLED CHILLER FROM "TRACE 600" = 104,640

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB	Irwin EEAP - Ft. Riley, Kansas
SHEET NO.	OF
CALCULATED BY MHM	DATE 3-8-91
CHECKED BY RDF	DATE
JOB NO. 5080	

ELECTRICAL BLDG 600, 610, 620, 621

KWH/YR

TOTAL ITEM 1-25 14,133,400

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 3-8-91
CHECKED BY RDF DATE ______
JOB NO. 5080

GAS BLDG 600, 610, 620 & 621

1 MCF = 1.031×10^6 BTU

AVERAGE BOILER EFFICIENCY FOR FY90 = 0.69

MCF

(1) DOMESTIC HOT WATER BLDG 600, 610, 620, 621
6,000,000 BTUH × 6 HR/DAY ÷ 0.8 EFF ÷ 0.69 ÷ 1.031×10^6
× 365 DAY/YR × 1.1 PIPING LOSS = 25,397

(2) STERILIZERS, GLASS & BEDPAN WASHERS
945,000 BTUH × 0.8 UF × 8760 HR/YR ÷ 0.69
÷ 1.031×10^6 × 1.1 PIPING LOSS = 10,240

(3) INCINERATOR
800,000 BTUH × 4 HR/DAY × 365 DAY/YR ÷ 1.031×10^6 = 1,133

(4) HUMIDIFICATION
3,460,000 BTUH × 0.8 LF × 180 DAY/YR × 24 HR/DAY ÷ 0.8 EFF = 23,112
÷ 0.69 EFF ÷ 1.031×10^6 × 1.1 PIPING LOSS

(5) KITCHEN EQUIPMENT
741,450 BTUH × 0.8 UF × 16 HR/DAY × 365 DAY/YR ÷ 1.031×10^6 = 3,360

(6) SPACE HEATING #600, #610, #620, #621
25,691 $\times 10^6$ BTU ÷ 0.69 ÷ 0.8 EX. EFF × 1.2 ÷ 1.031×10^6 = 54,170

(7) SPACE COOLING
14,565.2 $\times 10^6$ BTU ÷ 0.69 ÷ 1.031×10^6 = 20,467

TOTAL 1-7 137,879

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ______ OF ______
CALCULATED BY MHM DATE 3-8-11
CHECKED BY RDF DATE ______
JOB NO. 5080

GAS (cont)

⑥ SPACE HEATING BLDG 600

THE GAS INPUT TO THE BOILERS REQUIRED FOR SPACE HEATING IS BASED ON THE TRACE 600 SYSTEM LOAD PROFILE AND THE ACTUAL BOILER EFFICIENCY TAKEN FROM THE BOILER OPERATING LOG.

% LOAD	CAPACITY MBH	HOURS	BTU x10^6
5	1023.4	3695	3781
10	2046.9	824	1687
15	3070.3	1026	3150
20	4093.7	570	2333
25	5117.1	965	4938
30	6140.6	583	3580
35	7164.0	272	1949
40	8187.4	329	2694
45	9210.9	93	857
50	10234.3	0	
55	9940.0	0	
60	10852.7	0	
65	11757.1	0	
70	12661.5	0	
75	13565.9	0	
80	14470.3	0	
85	15374.6	0	
90	16279	0	
95	17183.4	0	
100	18087.8	0	
TOTAL			24,969

MNB
MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

JOB Irwin EEAP - Ft. Riley, Kansas
SHEET NO. ____ OF ____
CALCULATED BY MHM DATE 3-8-91
CHECKED BY RDF DATE ____
JOB NO. 5080

GAS (cont)

⑥ SPACE HEATING

BLDG 610 | BLDG 620 & 621

% LOAD	BLDG 610 CAPACITY MBH	BLDG 610 HOURS	BLDG 610 BTU x 10^6	BLDG 620 & 621 CAPACITY MBH	BLDG 620 & 621 HOURS	BLDG 620 & 621 BTU x 10^6
5	45.7	1,882	86	25	267	6.7
10	91.5	394	36	50	148	7.4
15	137.2	600	82.3	75	130	10
20	183	456	83.4	100	213	21.3
25	228.7	292	66.8	125	103	12.9
30	274.5	177	48.6	150	108	16.2
35	320.2	217	69.5	175	169	29.6
40	366	0		200	71	14.2
45	411.7	0		225	145	32.6
50	457.5	0		250	146	36.5
55	503.2	0		275	155	42.6
60	549	0		300	62	18.6
65	595	0		325	0	
70	640.5	0		350	0	
75	686.2	0		375	0	
80	732	0		400	0	
85	777.7	0		424.9	0	
90	823.5	0		449.9	0	
95	869.2	0		474.9	0	
100	915	0		499.9	0	
TOTALS			472.6			248.6

PLANT SPACE HEATING TOTAL

#600	24,969
#610	473
#620 & 621	249
	25,691 x 10^6 BTU/YR

JOB Irwin EEAP - Ft. Riley, Kansas

MNB

MASSAGLIA-NEUSTROM-BREDSON, INC.
CONSULTING ENGINEERS

SHEET NO. OF

CALCULATED BY MHM DATE 3-5-91

CHECKED BY RDF DATE

JOB NO. 5080

GAS (cont)

(7) SPACE COOLING

THE STEAM TURBINE CHILLER ACTUAL HOURS OF OPERATION WERE TAKEN FROM OPERATOR LOG SHEETS PROVIDED BY MR. IRA SCALES, PLANT OPERATIONS FOREMAN.

OCT 89	205
NOV 89	0
DEC 89	0
JAN 90	8
FEB 90	0
MAR 90	0
APR 90	0
MAY 90	5
JUN 90	1390
JULY 90	1484
AUG 90	1228
SEPT 90	1282
	5602

5602 HRS $\times$ 13 lb/$\frac{HR}{TON}$ $\times$ 1000 BTU/lb $\times$ 200 TON

$= 14565.2 \times 10^6$ BTU

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
307	1 FLR ADMIN	1	BRICK	.22					585	0		
		2	CONC	.12			820	220				
		3	BRICK	.22			424	c				
		4	SPANDREL	.085			110	0				
		5	CONC	.12							1630	400
		6	BRICK	.22							530	0
		7	SPANDREL	.085							250	0
310	2 FLR CORE	1	CONC	.12					448	100		
		2	SPANDREL	.085					32	0		
		3	BRICK	.22			120	0				
311	3 FLR CORE	1	CONC	.12			120	0				
		2	SPANDREL	.085					16	0		
		3	CONC	.12					248	40		
312	3 FLR CORE	1	BRICK	.22			120	0				
		2	CONC	.12	300	40						
		3	SPANDREL	.085	72	0						
313	4 FLR ADMIN	1	CONC	.12					472	100		
		2	SPANDREL	.085					32	0		
		3	BRICK	.22			72	0				
314	4 FLR CORE	1	BRICK	.22			260	80				
		2	BRICK	.22	408	60						
		3	SPANDREL	.085	24	0						

REF [illegible]: 1955 PHASE III ARCH SET DATED 7-15-86
1975 ARCH SET DATED 4-75

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
315	5 FLR CORE ADMIN	1	BRICK	.22			144	0				
		2	CONC	.12					472	80		
		3	SPANDREL	.085					32	0		
316	5 FLR CORE	1	BRICK	.22			168	40				
		2	BRICK	.22	430	60						
		3	SPANDREL	.085	24	0						
318	2 FLR A WING	1	BRICK	.22			384	0				
		2	CONC	.12			1230	300				
		3	SPANDREL	.085			380	0				
		4	BRICK	.22					528	0		
		5	BRICK	.22							480	0
		6	CONC	.12							1110	180
		7	SPANDREL	.085							380	0
319	3 FLR A WING	1	BRICK	.22			384	0				
		2	CONC	.12			1230	260				
		3	SPANDREL	.085			380	0				
		4	BRICK	.22					528	0		
		5	BRICK	.22							480	0
		6	CONC	.12							1110	180
		7	SPANDREL	.085							380	0

REFER: 1955 [illegible] III ARCH SET DATED 7-15-86
1975 ARCH SET DATED 4-[illegible]

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
320	4 FLR A WING	1	BRICK	.22			384	0				
		2	CONC	.12			1230	260				
		3	SPANDREL	.085			380	0				
		4	BRICK	.22					528	0		
		5	BRICK	.22							480	0
		6	CONC	.12							1110	260
		7	SPANDREL	.085							380	0
321	5 FLR A WING	1	BRICK	.22			384	0				
		2	CONC	.12			1230	260				
		3	SPANDREL	.085			380	0				
		4	BRICK	.22					528	0		
		5	BRICK	.22							480	0
		6	CONC	.12							1110	180
		7	SPANDREL	.085							380	0
322	1 FLR OP CLINIC	1	CONC	.12					700	200		
		2	SPANDREL	.085					104	0		
		3	CONC	.12							1530	40
		4	SPANDREL	.085							32	0
		5	CONC	.12	2600	160						
		6	SPANDREL	.085	64	0						
323	DINING	1	CONC	.12	426	160						
325	KITCHEN	1	CONC	.12	1620	40						
		2	SPANDREL	.085	128	0						
326	2 FLR B WING	1	BRICK	.22					384	0		
		2	CONC.	.12					500	80		

REFER: 1955 PHASE III ARCH SET DATED 7-15-[illegible]
1975 ARCH SET DATED 4-75

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
326		3	SPANDREL	.085					92	0		
		4	BRICK	.22	384	0						
		5	SPANDREL	.085	260	0						
		6	CONC	.12	700	200						
327	2 FLR B WING OFC	1	CONC	.12	310	40						
		2	SPANDREL	.085	72	0						
		3	CONC	.12					290	40		
		4	SPANDREL	.085					140	0		
328	3 FLR B WING CLASS	1	CONC	.12					156	20		
		2	SPANDREL	.085					84	0		
329	3 FLR B WING PAT.	1	CONC	.12					1100	280		
		2	SPANDREL	.085					364	0		
		3	BRICK	.22					384	0		
		4	CONC	.12							720	0
		5	CONC	.12	1388	200						
		6	SPANDREL	.085	364	0						
330	4 FLR B WING PAT.	1	BRICK	.22					770	0		
		2	SPANDREL	.085					196	0		
		3	CONC	.12					524	120		
		4	CONC	.12							528	0
		5	SPANDREL	.085	196	0						
		6	CONC	.12	800	200						
331	4 FLR B WING OFC	1	CONC	.12	820	80						
		2	SPANDREL	.085	140	0						
		3	CONC	.12							576	0

REFER: [illegible] PHASE III ARCH SET DATED 7-15-86
[illegible] ARCH [illegible] DATED 4-75

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
331	4 FLR B WING OFC	4	CONC	.12					832	160		
		5	SPANDREL	.085					224	0		
332	5 FLR "B" WING OFC	1	BRICK	.22					384	0		
		2	SPANDREL	.085					224	0		
		3	CONC	.12					936	160		
		4	SPANDREL	.085	140	0						
		5	CONC	.12	820	80						
333	1 FLR DNTL SURGERY	1	CONC	.12					286	100		
		2	SPANDREL	.085					112	0		
335	1 FLR DNTL CLINIC	1	BRICK	.22					425	0		
		2	SPANDREL	.085					72	0		
		3	CONC	.12					730	16		
336	2 FLR ICU	1	CONC	.12					524	120		
		2	SPANDREL	.085					196	0		
		3	CONC	.12							504	0
		4	SPANDREL	.085	250	0						
		5	CONC	.12	710	200						
337	5 FLR RECOVERY	1	CONC	.12					168	40		
		2	SPANDREL	.085					72	0		
		3	CONC	.12							504	0
		4	CONC	.12	168	40						
		5	SPANDREL	.085	72	0						
338	5 FLR PAT	1	CONC	.12	660	80						
		2	SPANDREL	.085	228	0						

REFER: 1955 PHASE III ARCH SET DATED 7-15-86
1115 ARCH SET DATED 4-75

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
340	5 FLR MOBIL OR's	1	CONC	.12					256	0		
		2	SPANDREL	.085					224	0		
341	BSMT "C" WING	1	CONC	.12							1352	200
		2	SPANDREL	.085							248	0
		3	CONC	.12	980	0						
		4	CONC	.12			915	120				
		5	SPANDREL	.085			152	0				
342	1 FLR SOCIAL DISEASE	1	CONC	.12	576	0						
		2	SPANDREL	.085			92	0				
		3	CONC	.12			1396	220				
		4	SPANDREL	.085							84	0
		5	CONC	.12							972	140
343	2 FLR O.R.	1	SPANDREL	.085			28	0				
		2	CONC	.12			212	0				
		3	SPANDREL	.085	16	0						
		4	CONC	.12	464	0						
344	2 FLR STERIL	1	CONC	.12	140	0						
		2	SPANDREL	.085	16	0						
345	2 FLR RECOVERY	1	CONC	.12							240	0
346	2 FLR OR SUPPORT	1	CONC	.12	1080	240						
		2	SPANDREL	.085	96	0						
348	3 FLR DELIVERY	1	CONC	.12	324	64						
		2	CONC	.12			466	0				
349	3 FLR STERIL	1	CONC	.12			156	0				
		2	SPANDREL	.085			16	0				

REFER: 1955 PHASE III ARCH SET DATED 7-15-56
197_ ARCH SET DATED 4-75

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
350	3 FLR LABOR	1	CONC	.12	232	0						
		2	SPANDREL	.085	32	0						
351	3 FLR OB	1	CONC	.12	384	32						
		2	CONC	.12			380	32				
		3	SPANDREL	.085			16	0				
		4	CONC	.12							1070	160
		5	SPANDREL	.085							16	0
401	BSMT CLINIC	1	CONC	.13			886	293				
		2	SPANDREL	.073			234	0				
		3	BRICK	.13	1008	160						
402	BW11 INCINERATOR	1	BRICK	.13					324	0		
		2	BRICK	.13			304	0				
403	1 FLR CLINIC	1	BRICK	.13			913	190				
		2	SPANDREL	.073			153	0				
		3	SPANDREL	.073	216	0						
		4	BRICK	.13	1065	300						
404	1R4 PT EXERCISE	1	CONC	.13	220	100						
		2	SPANREL	.073	99	0						
405	2 FLR ADMIN	1	CONC	.13	1476	405						
		2	SPANDREL	.073	324	0						
		3	CONC	.13			702	293				
		4	SPANDREL	.013			234	0				
406	1 FLR E.R. SUPPORT	1	CONC	.13			1025	400				
		2	SPANDREL	.073			297	0				

REF: 1985 PHASE III ARCH SET DATED 7-15-86
1975 [illegible] SET DATED 4-75

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
407	1 FLR EMERGENCY	1	BRICK	.13			533	203				
		2	CONC	.13			1306	0				
		3	SPANDREL	.073			162	0				
		4	BRICK	.13					304	0		
		5	CONC	.13					304	0		
409	1 FLR AMBULANCE	1	BRICK	.13			200	0				
		2	BRICK	.13					375	0		
		3	BRICK	.13							200	96
410	1 FLR OP CLINIC	1	BRICK	.13					760	416		
		2	CONC	.13					952	0		
		3	SPANDREL	.073					333	0		
		4	BRICK	.13							296	0
		5	CONC	.13							421	115
		6	SPANDREL	.073							90	0
417	2 FLR A.V CLINIC	1	CONC	.13					672	0		
		2	BRICK	.13					880	506		
		3	BRICK	.13			295	158				
		4	CONC	.13			224	0				
		5	SPANDREL	.073			153	0				
421	BSMT PSYCHIATRIC	1	BRICK	.13	415	320						
		2	SPANDREL	.073	225	0						
		3	CONC	.13	480	0						
424	1 FLR ALLERGY CLINIC	1	CONC	.13	364	0						
		2	SPANDREL	.073	108	0						
		3	BRICK	.13	364	156						

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
426	2 FLR O.T.	1	BRICK	.13							112	0
		2	CONC	.13							224	0
		3	BRICK	.13							168	80
430	1 FLR LAB	1	CONC	.13					387	192		
		2	SPANDREL	.073					133	0		
438	2 FLR CHAPEL	1	CONC	.13					540	252		
439	2 FLR CORR	1	CONC	.13							60	0
441	3 G90 CORR	1	BRICK	.13					72	0		
		2	CONC	.13					468	284		
		3	BRICK	.13	72	0						
		4	CONC	.13	468	284						
442	BSMT BULK STOR	1	BRICK	.13			1008	0				
447	BSMT SNACK SHOP	1	CONC	.13	228	0						
		2	SPANDREL	.073	108							
		3	BRICK	.13	196	135						
		4	SPANDREL	.073			54	0				
		5	BRICK	.13			288	102				
		6	CONC	.13			234	0				
		7	BRICK	.13							112	0
504	MECH BK9, 3D18, 5C1, 5C2	1	CONC	.13							672	0
		2	CONC	.13	336	0						
		3	CONC	.13					240	0		

[illegible] PHASE III ARCH SET DATED 7-15-86
1915 ARCH SET DATED 4-1[illegible]

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
505	2 FLR PENTHOUSE	1	METAL	.085	1206	0						
		2	METAL	.085					1224	0		
		3	METAL	.085							1674	0
507	4 FLR PENT 407	1	METAL	.085	864	0						
	& 407 A	2	METAL	.085			2208	0				
		3	METAL	.085							2208	0
506	3 FLR PENT 3H1	1	METAL	.085	3220	0						
		2	METAL	.085			1340	0				
		3	METAL	.085					3220	0		
		4	METAL	.085							600	0
508	6 FLR PENT 6A-1 to 6E-1	1	METAL	.085	3336	0						
		2	METAL	.085			3490	0				
		3	METAL	.085					3430	0		
		4	METAL	.085							2772	0
510	ELEV PENTHOUSE	1	METAL	.085	192	0						
		2	METAL	.085			160	0				
		3	METAL	.085					192	0		
		4	METAL	.085							160	0
509	STAIRS 1-5 & A-F	1	BRICK	.29	3088	0						
		2	BRICK	.29			4045	0				
		3	BRICK	.29					3666	0		
		4	BRICK	.29							2995	0

REFERENCE [illegible] PHASE III [illegible] DATED [illegible] 86
1975 [illegible] DATED 4-75

EXTERIOR WALL AND GLASS DESCRIPTION

ZONE NO.	DESCRIPTION	WALL NO. TRACE	WALL TYPE	WALL "U"	NORTH AREA		EAST AREA		SOUTH AREA		WEST AREA	
					WALL	GLASS	WALL	GLASS	WALL	GLASS	WALL	GLASS
510	ELEV EQUIP 7 FLR	1	METAL	.085	192							
		2	METAL	.085			160					
		3	METAL	.085					192			
		4	METAL	.085							160	
511	ENERGY PLANT	1	CONC	.51	1552	75						
		2	CONC	.51			2752	450				
		3	CONC	.51					1552	0		
		4	CONC	.51							2752	425

5080

IRWIN ARMY HOSPITAL - EEAP
MEMORADUM FOR RECORD
CONFERENCE MINUTES

On March 6, 1991 a meeting was held at Fort Riley. The purpose of the meeting was to discuss the study for purchase of the hospital substation and alternatives to re-feed it. The following were in attendance:

Ronald Haynes -	DEH Design Branch	(913) 239-3239
Don Wainwright -	DEH Ext. Utilities	(913) 239-3832
Larry Stillwagon -	DEH Energy Section	(913) 239-2371
Damon Mick -	DEH Design Branch	(913) 239-3239
Richard Daugherty -	MNB, Inc.	(816) 931-2200
Carl Smart -	MNB, Inc.	(816) 931-2200

The following items were discussed:

1. It was determined that the existing line feeding the hospital has sufficient capacity for present and future projected hospital loads, but probably not sufficient capacity for a new hospital.

2. A new substation is schedule to be built at Camp Funston as a MCA project with estimated "on line" date of 1995. Presently, it is proposed to feed this new substation from Custer Hill substation no. 1 by a new 34.5 KV line to be constructed under the same MCA project.

3. The reliability of Anzio substation was discussed. Anzio substation has two separate 115 KV feeds and two 115 KV to 34.5 KV transformers. However, it was decided to investigate the cost to leave the existing metering station and feed point to KPL's 34.5 KV line at the hospital substation as a potential emergency source. It was agreed this was not a mandatory requirement but would be a nice feature if not cost prohibitive.

4. One EEAP study option is to buy hospital substation and build 34.5 KV line from main post turn off (steel pole) to MAAF, to hospital substation. Meter all through Anzio. Will need to add one air break switch.

5. Another EEAP option is to build a new substation in the vicinity of the hospital and feed it with a new 34.5 KV line metered through Anzio substation.

6. Several proposed new line routes to connect the hospital substation to Anzio substation were discussed. The merits and drawbacks of each route were considered with emphasis placed on terrain, cost, impact on future projects and reliability of the final distribution network. It was observed that all the proposed line routes were of

approximately the same length. So, for consistency in the EEAP study it was agreed to establish the following standard lengths: New 34.5 KV line to existing hospital substation - 15,000 LF. New 34.5 KV line to new hospital substation 11,000 LF.

7. New substation, if required, will need bays for four (4) switches, two of which will be future. Assume 5/7 thousand KVA size. Recently a similar transformer was purchased at an approximate cost of $500,000.

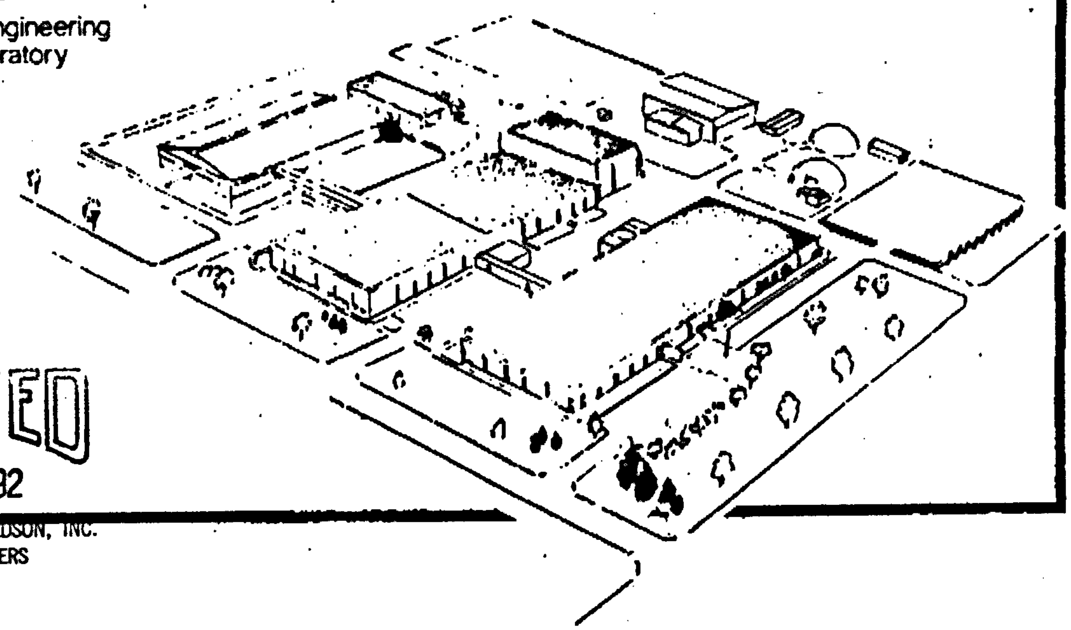
8. Standard 34.5 KV line construction is REA vertical type, 60', Class II poles, 250' span with a corner estimated every 7th span.

9. Estimated annual substation maintenance cost is $2,500 which includes Government personnel cost, supplies and contracted services. This maintenance cost is applicable to existing hospital substation or new hospital substation.

cc: All in attendance
Bob McCormick, CEMRK-ED
Randy Frymire, MNB

US Army Corps of Engineers

Construction Engineering Research Laboratory



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APR 1 0 1992

MASSAGLIA - NEUSTROM = BREDSON, INC.
CONSULTING ENGINEERS

FACSIMILE TRANSMITTAL HEADER SHEET

For use of this form, see AR 25-11, the proponent agency is ODISC4

	COMMAND/ OFFICE	NAME/ OFFICE SYMBOL	OFFICE TELEPHONE NO. (FTS/Commercial)	FAX NO. (FTS/Commercial)
FROM:	USACERL	NOEL POTTS/ ESP	(217) 398-5545	(217) 373-3430
TO:	M.N.B. CONSULTING ENGR.	RANDY FRYMIRE	(816) 931-2200	(816) 931-5339

CLASSIFICATION	PRECEDENCE	NO. PAGES (Including this Header)	DATE-TIME	MONTH	YEAR	RELEASER'S SIGNATURE
NONE	NONE	16	16:30 10	APR	92	Noel L. Potts

REMARKS

Space Below For Communications Center Use Only

DA FORM 3918-R, JUL 90 — DA FORM 3918-R, AUG 72 IS OBSOLETE

ENERGY CONSERVATION MEETING WITH FORT RILEY D.E.H.
ATTENDED BY USACERL AT M.N.B. CONSULTING ENGINEERS
KANSAS CITY, MO
13 FEB 92

The DEH and MNB discussed chillers, energy saving alternatives, and boiler replacement. Gary Cler and Mike Binder handled information on non-boiler subjects. Noel Potts discussed boilers.

Irwin Hospital at Ft. Riley has 370,000 ft^2 with its energy plant located on the north side. This plant serves the hospital plus a vicinity nurses residence and family housing. The steam system is operated at 120 psig. Hot water is generated with heat exchangers. Peak demand is 22,000 pph (summer - absorption chillers); minimum demand is 8,000 pph. The plant was built in 1955 and expanded 1975. It has two 34,000 pph B&W "D" type boilers fired on natural gas and #2 oil. Boiler tubes were reported to be fine. These boilers have both FD and ID fans which are not matched or coordinated with controls. The cost of gas is $3.70/mcf.

The DEH is considering eliminating chiller steam requirements, separating the nurses residence and family housing from the hospital and serving them with separate units, and installing a third small boiler for low loads. This installation would require relocation of computer equipment in the boilerhouse. They would like to replace their pneumatic control system with an electronic control system due to problems with FD/ID fan balancing, oxygen trim, and gas-oil change over. They would also like a boiler management system to eliminate requirements for a full-time operator. They have quotes on two types of Gordon-Piatt replacement burners (FD) for the existing boilers.

Noel Potts suggested that replacement burners with a 5:1 turn down are available for existing boilers and that a third boiler is not necessary. They could get controls for automatic gas-oil change over and oxygen trim and connect the boilers to a boiler management system. All pneumatics and the ID fans would thus be eliminated. Plant steam pressure requirements could be analyzed (air vs. steam atomization) in addition to reducing branch systems pressure (nurses residence and family housing) by using steam dispatching. Prior to planning any changes, the boilers should be examined for tube and drum condition (expected life) and for leaks between furnace and secondary passage. Ira Scales, Irwin Hospital boiler chief, said these are all good.

As a result of this initial meeting with Ft. Riley DEH and their consulting engineers, USACERL suggests acting to:

1. Outline tube, drum, etc. inspection to determine expected boiler life.

2. Determine from B&W if boiler walls, etc. can take pressure change resulting from eliminating ID fan and using FD only.

3. Provide information on burners, oxygen trim, and boiler management systems.

4. Get better load records to determine if boilers can be derated with smaller burners.

5. Investigate using economizers in stacks for heat recovery.

6. Get steam distribution system details to determine applicability of steam dispatch system.

7. Coordinate all boiler system changes with other energy conservation measures for optimum mix.

RESPONSE TO 13 FEB 92 ENERGY CONSERVATION MEETING
AT KANSAS CITY, MO FOR FORT RILEY, KS

As a result of the initial meeting with Ft. Riley DEH and their consulting engineers, USACERL suggested several points for further action. These points are listed below along with our response to them:

1. Outline tube, drum, etc. inspection to determine expected boiler life.

Using a non-destructive examination technique such as x-ray, boiler tubes, drums, and tube-drum connection points should be examined to determine remaining metal thickness. Based on details of the water treatment program, a projection of expected boiler life could be made and the feasibility of renovating existing burners and controls could be evaluated. We estimate these tests to cost $5000.

2. Determine from B&W if boiler walls, etc. can take pressure change resulting from eliminating ID fan and using FD only.

Through a phone contact with the Irwin Hospital boiler plant, USACERL has learned that the boilers are B&W "FF" type field erected rather than the "D" type we had previously understood.

Eliminating the ID fan is not practical due to the "FF" boiler construction. This boiler has a false furnace floor over a chamber through which combustion air is drawn from the rear of the boiler to the burner windbox. This floor is not air- or gas-tight, and making it air-tight is not cost effective. Any positive pressure differential of the furnace with respect to the combustion air chamber will recirculate combustion gases back into the combustion air. With FD fans only, the furnace pressure would increase greatly so that combustion gases could be moved through the downstream convective tube passages and breeching. The recirculation rate would be unacceptable. The ID fan must be retained to overcome the pressure drop downstream of the furnace, providing a slightly negative furnace pressure.

The best modification concerning the ID fan would be to replace the constant speed motor and control dampers with a variable speed motor modulated to control furnace pressure. This change should pay back within two years.

3. Provide information on burners, oxygen trim, and boiler management systems.

Retention of the ID fans does not negate the benefit of replacing the existing burners with high-efficiency high-turndown burners. For this type of boiler, stack O_2 levels could be 4% (compared to

the existing 7.9%) and turndown could be 5:1. With proper sizing of such burners (see item 4 below), the addition of a third, small boiler is unnecessary. Replacement of burners for both existing boilers would cost about $220,000 including removal, installation, and start-up.

A replacement burner should have a single FD fan mounted atop a single windbox serving two burner/registers. We feel that two burners are required per boiler because of the short furnace length and the danger of flame impingement on the rear wall with a single burner. Ultimately, all revisions of the combustion system of these boilers should be coordinated with a reputable burner manufacturer, such as Coen or Faber, who is accustomed to working with **water tube** boiler applications.

We are not certain of the cause of present difficulties with the ID fan, O_2 trim, and boiler controls. Complete evaluation would require a site visit. As a starting point though, a worst case condition would be complete replacement of all controls which would cost about $40,000. The correct approach for ID fan control would be to maintain a slightly negative pressure set-point in the furnace. O_2 trim signals should go to the FD fan only.

Attached is a brochure of a boiler management controller. We estimate such a system to cost $7,000 installed and operating. Such a system could be operated either as a stand-alone or as part of an EMCS. Benefits could be evaluated through reduced man-hours required for boiler operation.

4. Get better load records to determine if boilers can be derated with smaller burners.

The burner size (and ID fan size) should be based on historical loads and any proposed system modifications which will affect heating load, such as heat-recovery gas-fired chillers.

5. Investigate using economizers in stacks for heat recovery.

This is definitely an energy conservation measure to be strongly considered. An economizer will increase boiler efficiency by 3- or 4% by preheating boiler feedwater. If heat from the flue gases can be used beneficially by a lower temperature heat sink, condensing heat exchangers should be considered. Additional study is also required to determine the space limitations and increased ID fan load.

6. Get steam distribution system details to determine applicability of steam dispatch system.

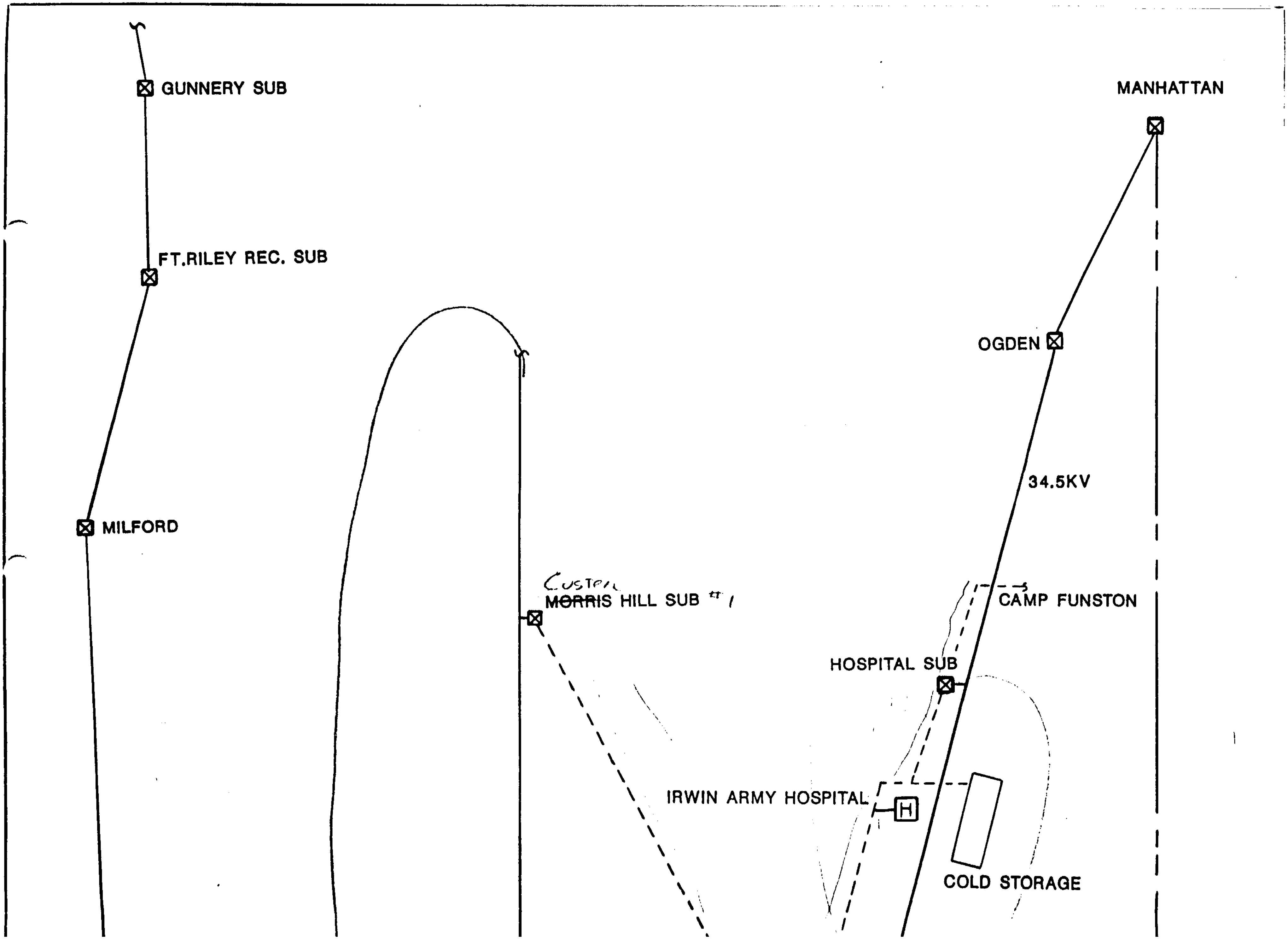
The DEH is considering detaching the nurses residence and family housing from the central steam system and serving them with in-house boilers. This measure is costly and the payback is

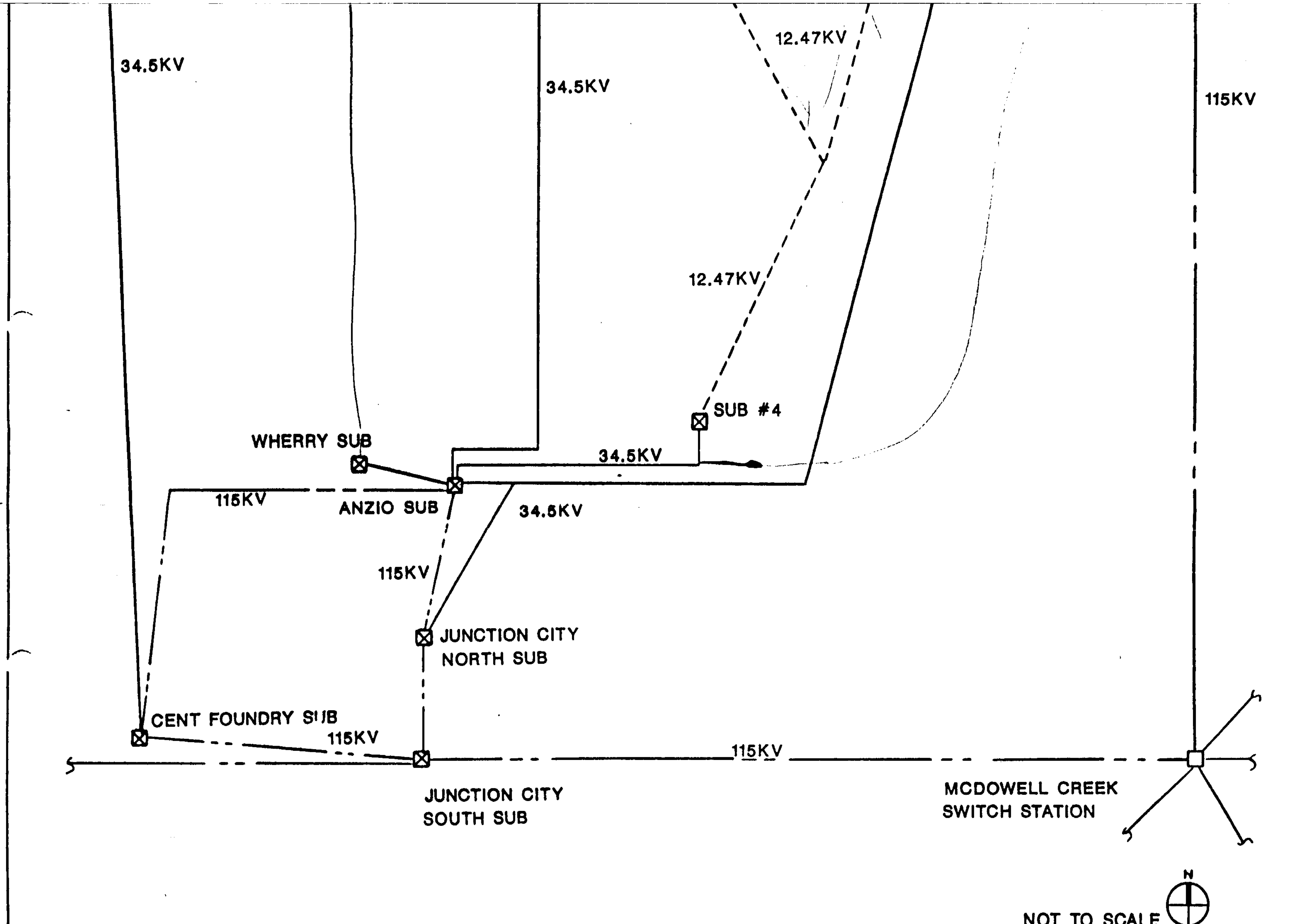
extremely long. An attractive alternative is steam dispatching for the existing system.

Steam distribution losses usually represent a significant portion of a central heat plant's output. These losses are comprised of leaking steam traps and pipes, and pipe radiation. In addition to increasing maintenance on these items, one relatively simple solution to reducing system losses is reducing system steam pressure. Through remote controlled pressure reducing stations, the main and branch pressures are reduced to the minimum pressure required by the function the branch serves while maintaining return of condensate. Steam dispatching could save 5- to 10% of energy output, would cost roughly $100,000, and would pay for itself in less than four years. The attached article gives more detail on steam dispatching.

7. Coordinate all boiler system changes with other energy conservation measures for optimum mix.

(no response at this time)

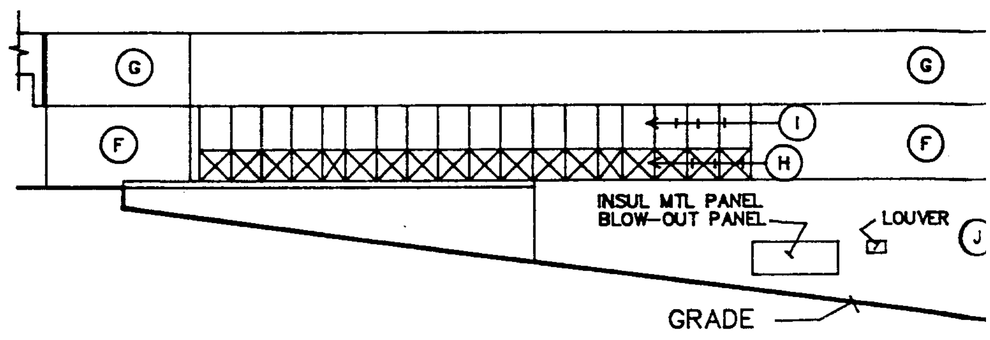

GUNNERY SUB
FT.RILEY REC. SUB
MILFORD
MANHATTAN
OGDEN
34.5KV
Custer
~~MORRIS~~ HILL SUB #1
CAMP FUNSTON
HOSPITAL SUB
IRWIN ARMY HOSPITAL
H
COLD STORAGE

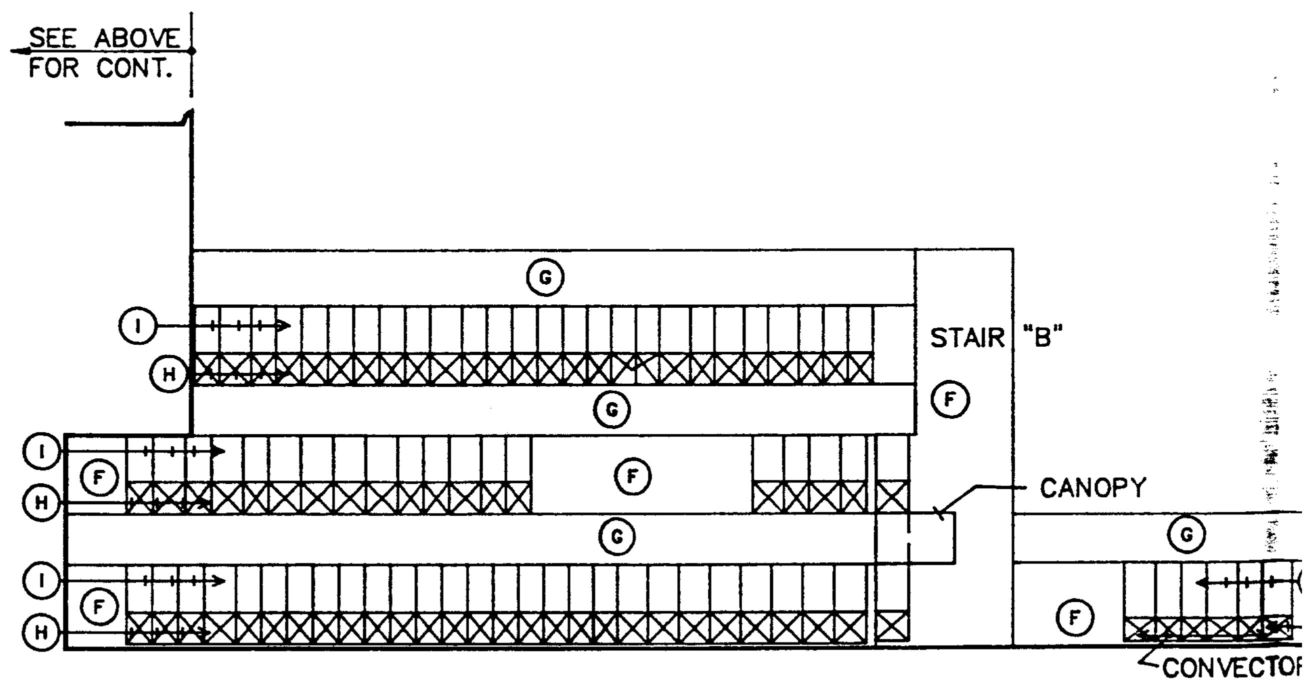


ELECTRIC UTILITY ONE LINE DIAGRAM

LEGEND

- (A) —— FACE BRICK/CONVECTOR SPACE
- (B) —— POURED IN PLACE CONCRETE
- (C) —— METAL WALL PANEL
- (D) —— INSULATED PANEL (1955 BUILDING)
- (E) —— INSULATED GLASS (1955 BUILDING)
- (F) —— FACE BRICK / BLOCK
- (G) —— PRECAST CONCRETE PANEL
- (H) —— INSULATED PANEL (1975 BUILDING)
- (I) —— INSULATED GLASS (1975 BUILDING)
- (J) —— FACE BRICK / CONCRETE
- (K) —— SINGLE PANE GLASS IN ALUMINUM FRAME
- (L) —— SINGLE PANE GLASS IN STEEL FRAME
- (M) —— INSULATED HOLLOW METAL DOOR ASSEMBLY
- (N) —— CONCRETE CANOPY OVER WINDOWS
- (O) —— HOLLOW METAL DOOR & FRAME WITH GLASS LIGHT
- (P) —— LOUVER
- (Q) —— ALUMINUM AND GLASS DOOR ASSEMBLY

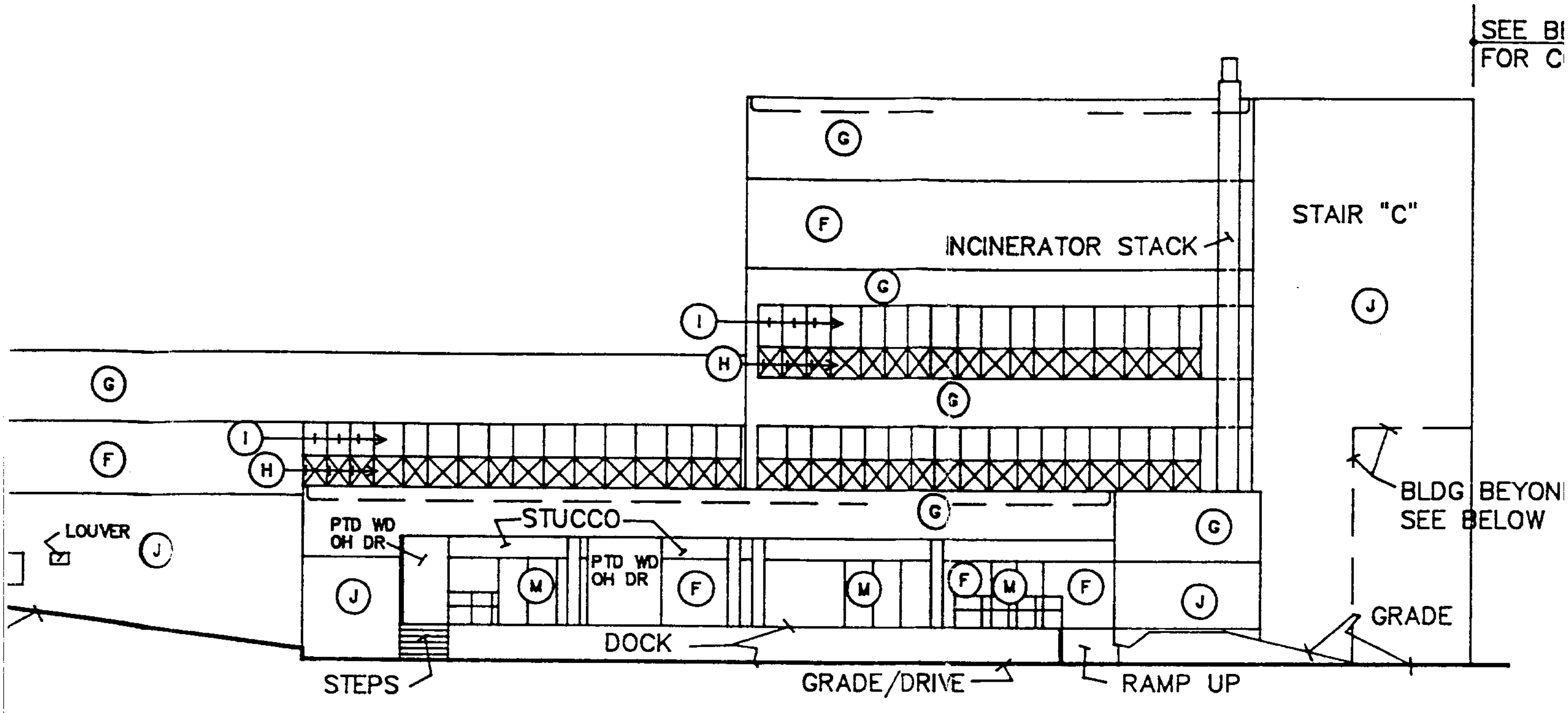




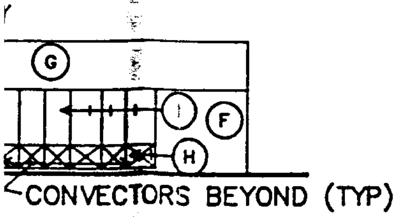
EAST ELEVATION (NORTH PORTION)

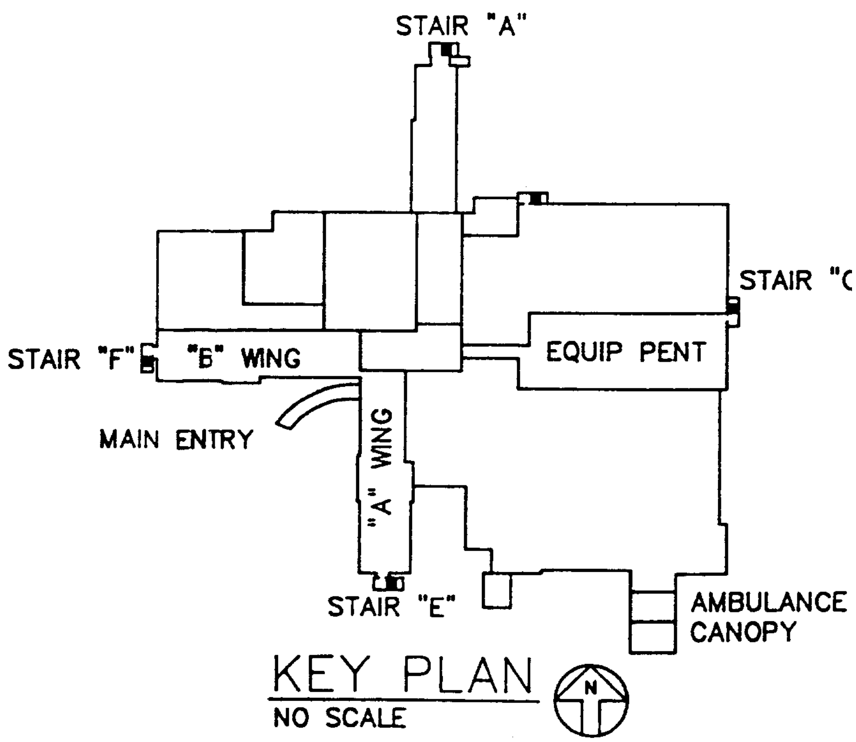
1975 BUILDING

1"=20'-0"



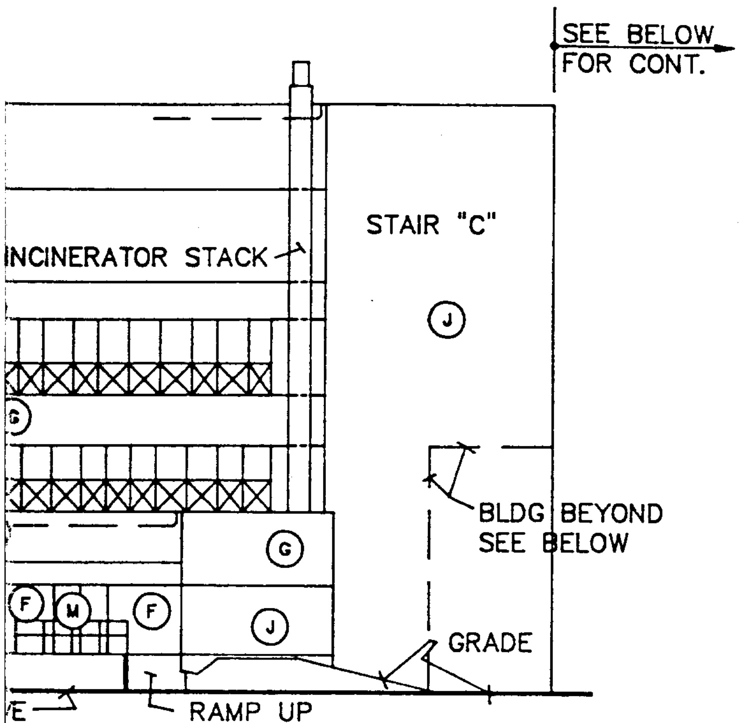
EAST ELEVATION (SOUTH PORTION)

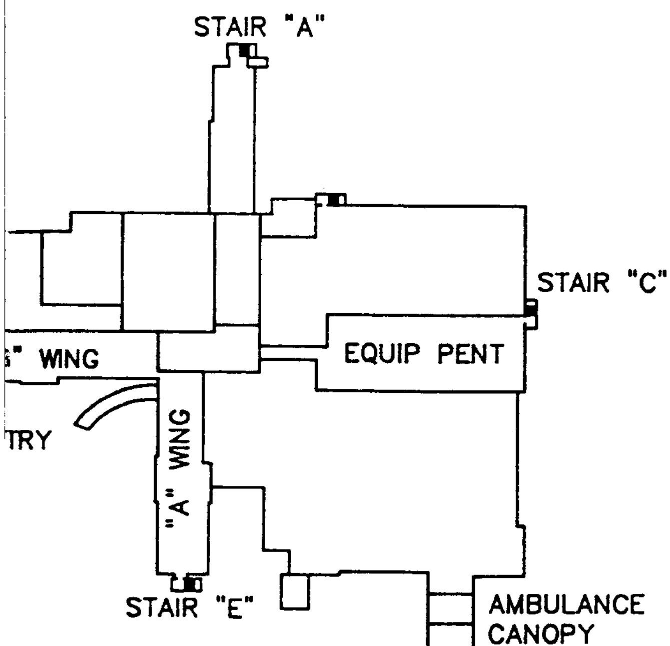




KEY PLAN

NO SCALE

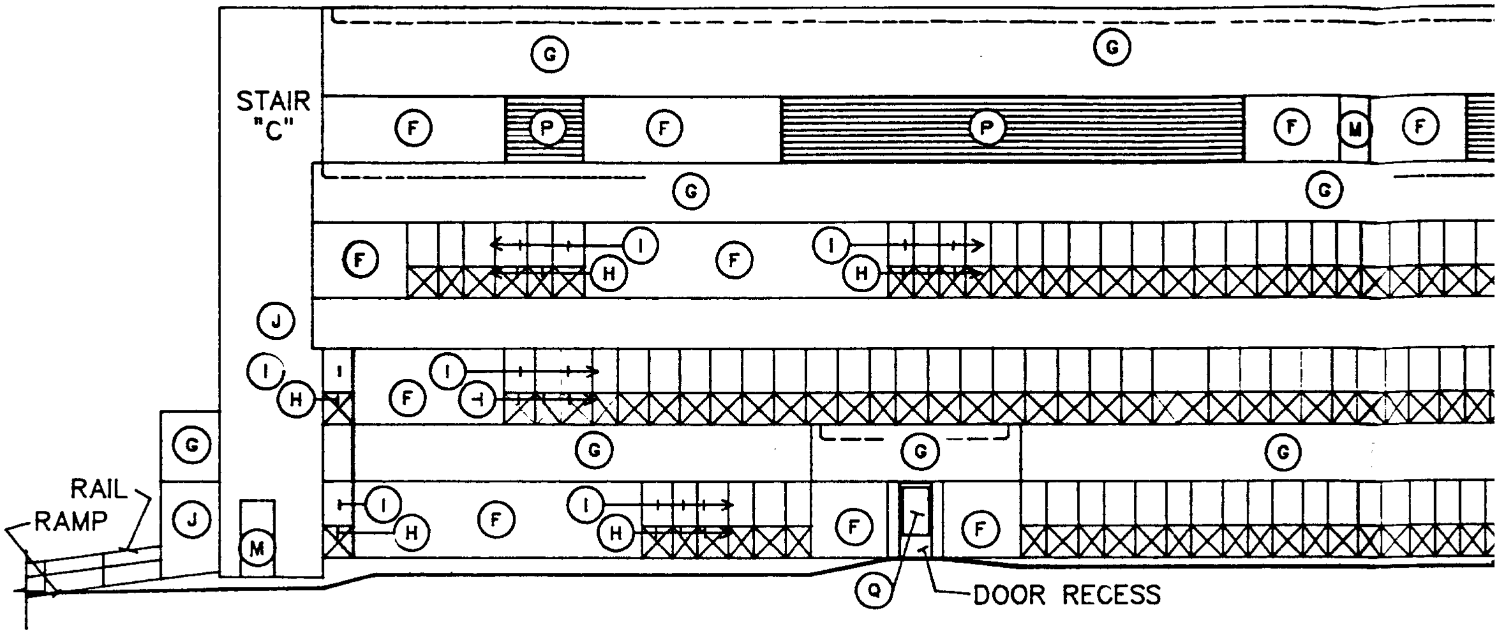




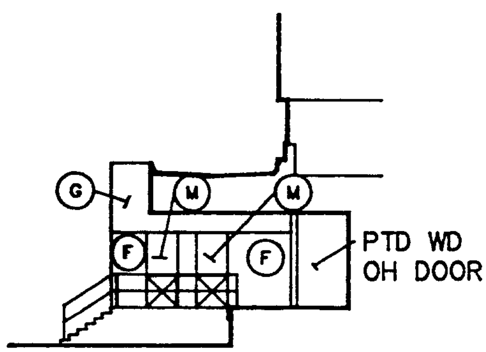
KEY PLAN

NO SCALE

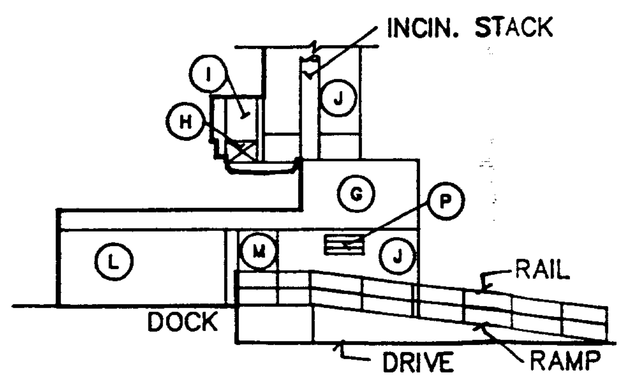
DRAWING No. 1 OF 7



NORTH ELEVATI



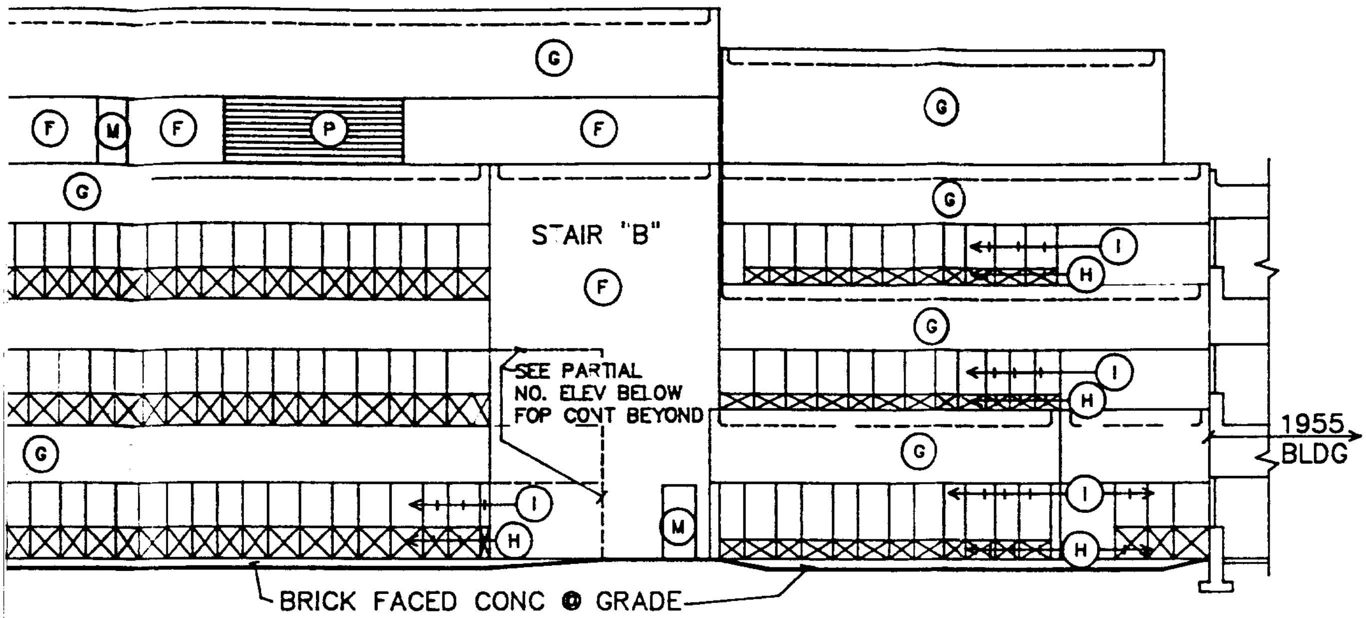
NORTH ELEV @ DOCK



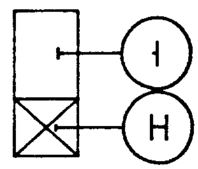
SOUTH ELEV @ DOCK

1975 BUILDING

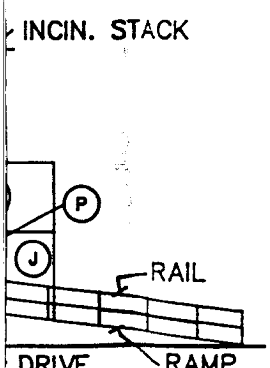
1" = 20.0'



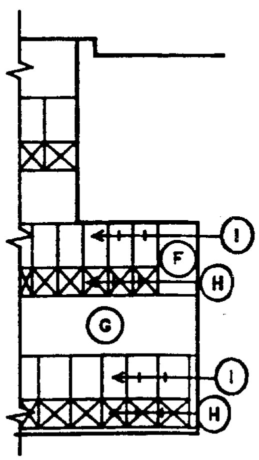
H ELEVATION



WINDOW LEGEND
1975 BUILDING

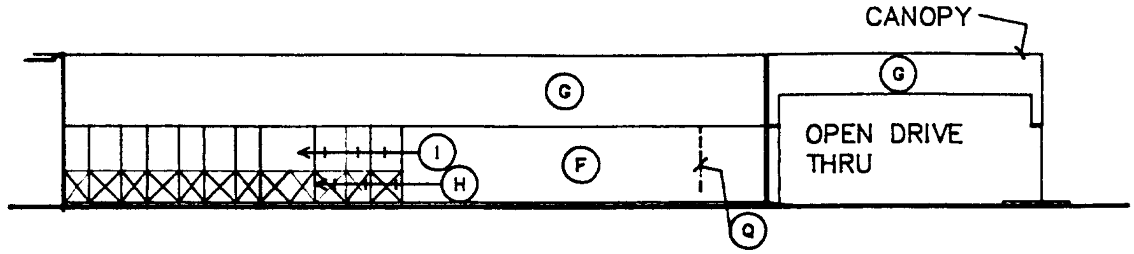


@ DOCK

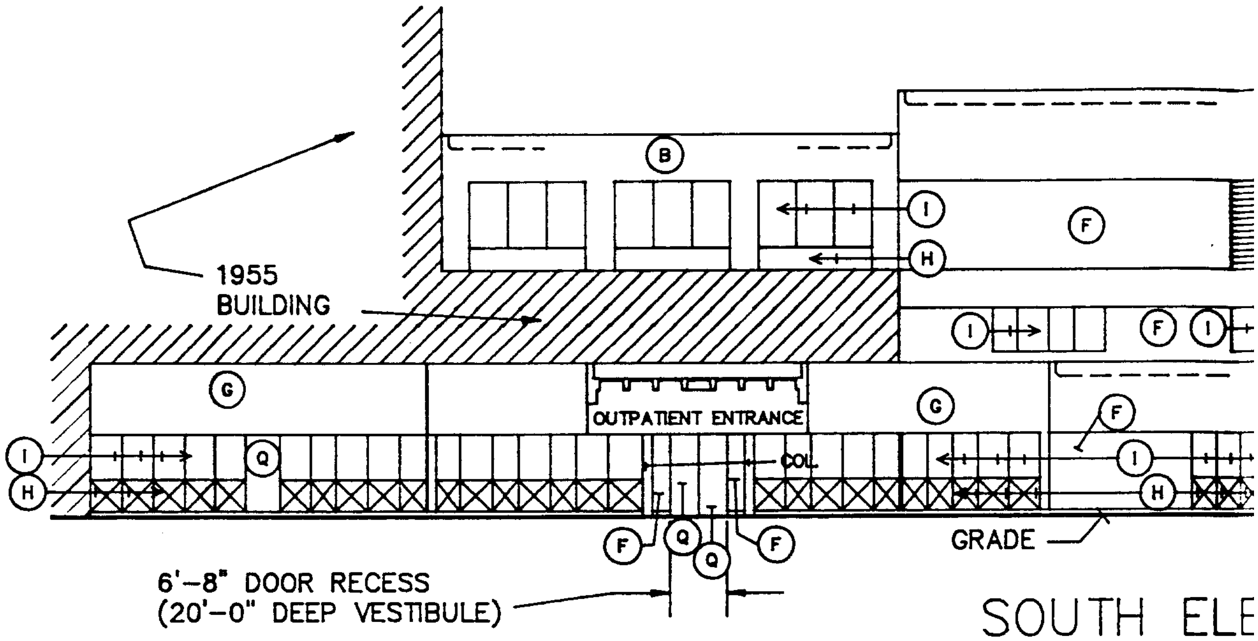


PARTIAL NORTH ELEV.

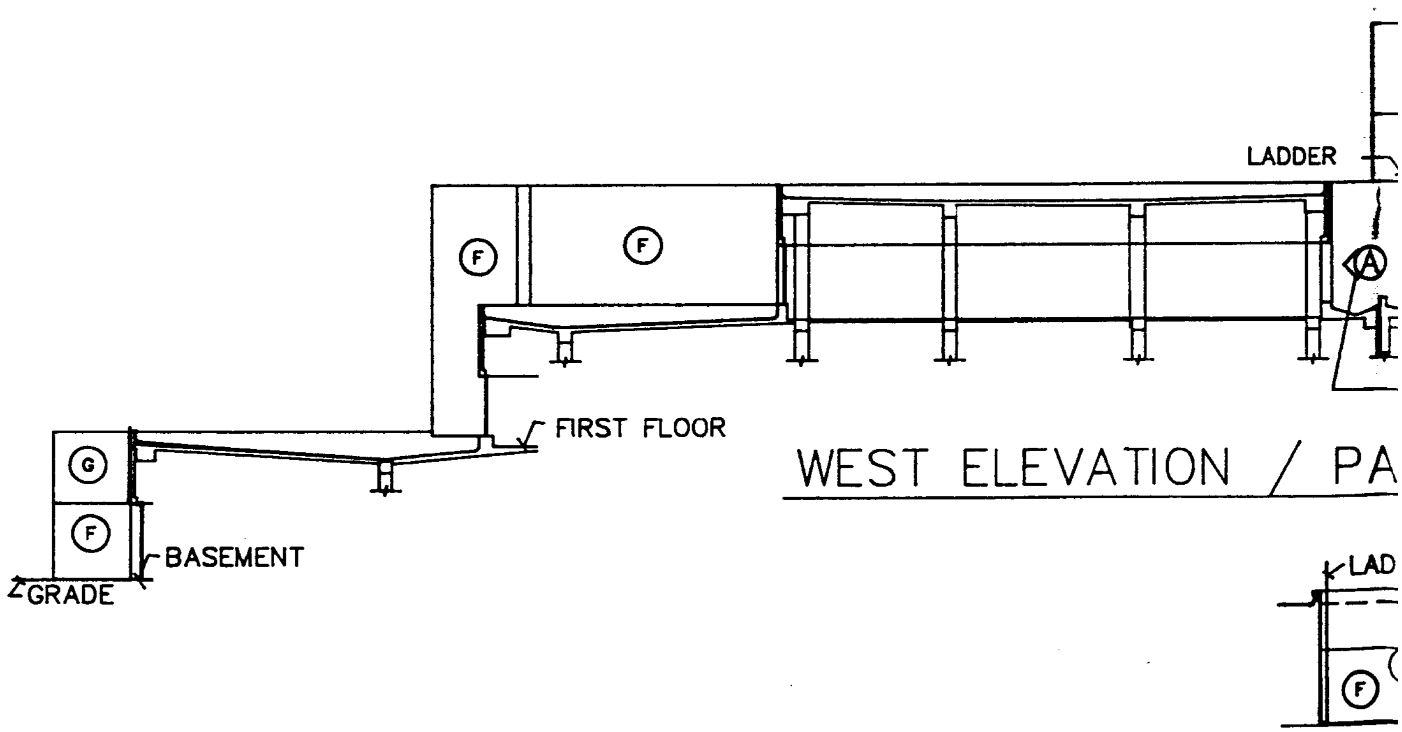
SEE NORTH ELEVATION



WEST ELEVATION – OUTPATIENT ENTRY



SOUTH ELE

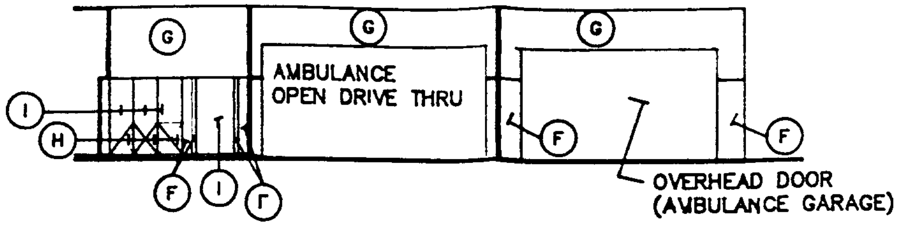


WEST ELEVATION / PA

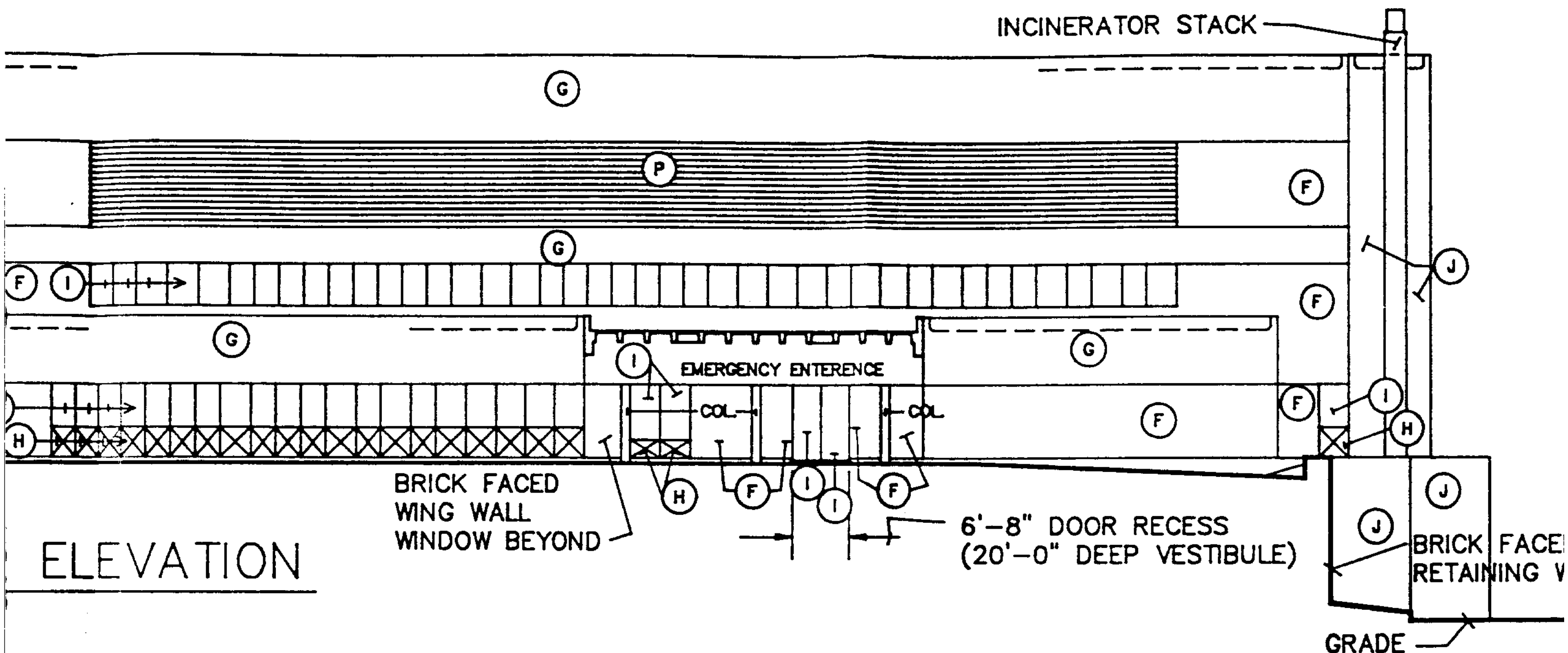
E

1975 BUILDING

1"=20'-0"



WEST ELEVATION – EMERGENCY ENTRY



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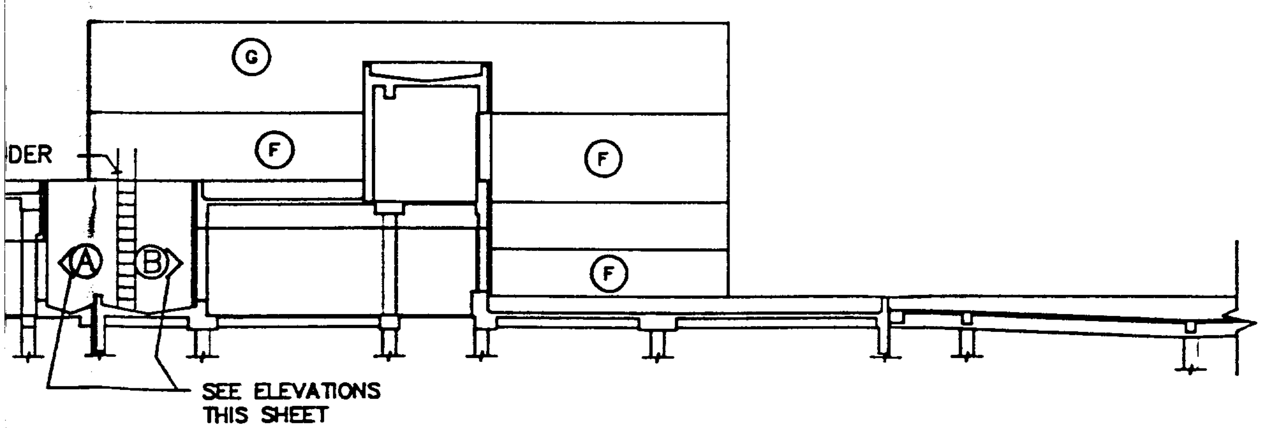
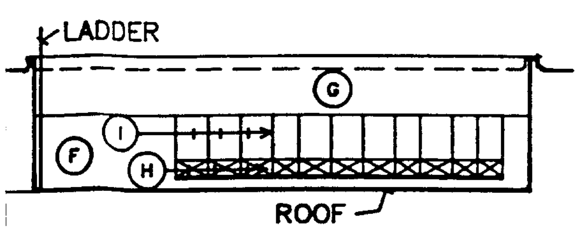


PARTIAL BUILDING SECTION



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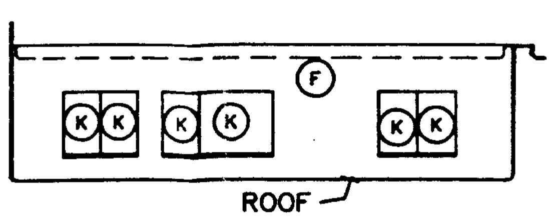

ELEVATION "B"

CHAPEL/MEDITATION ROOM

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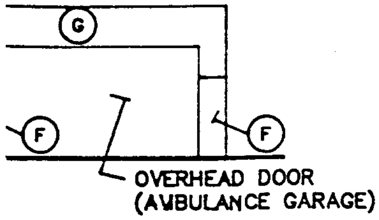
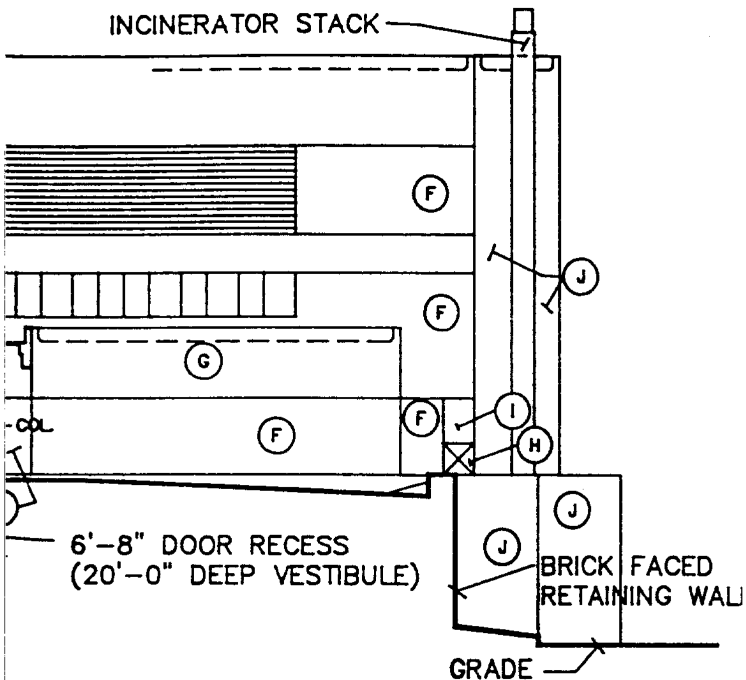
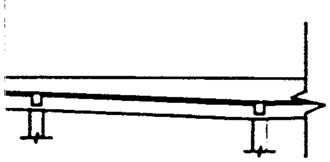
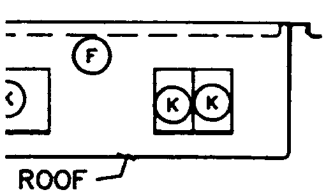


- EMERGENCY ENTRY







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EDITATION ROOM

287

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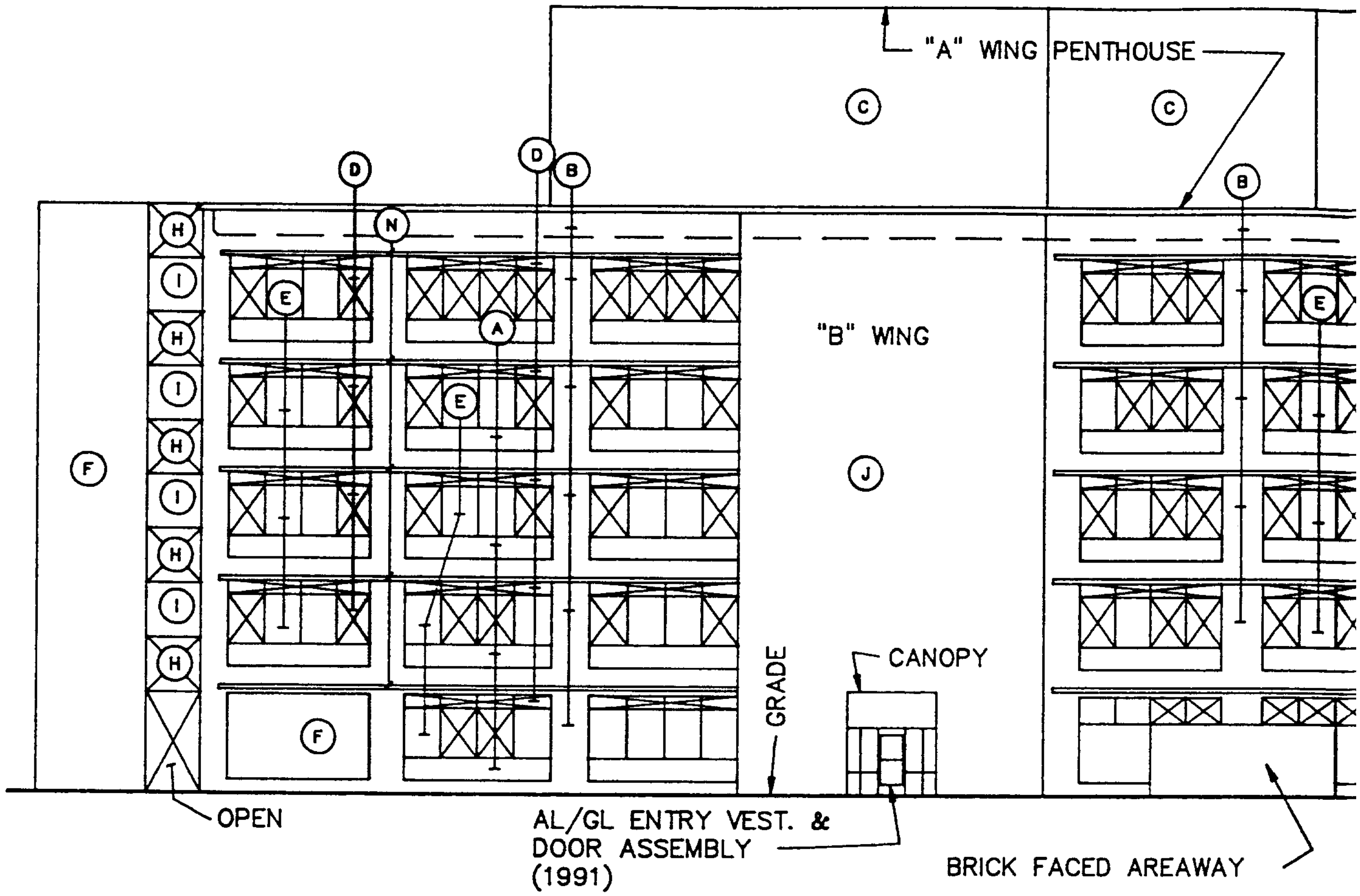
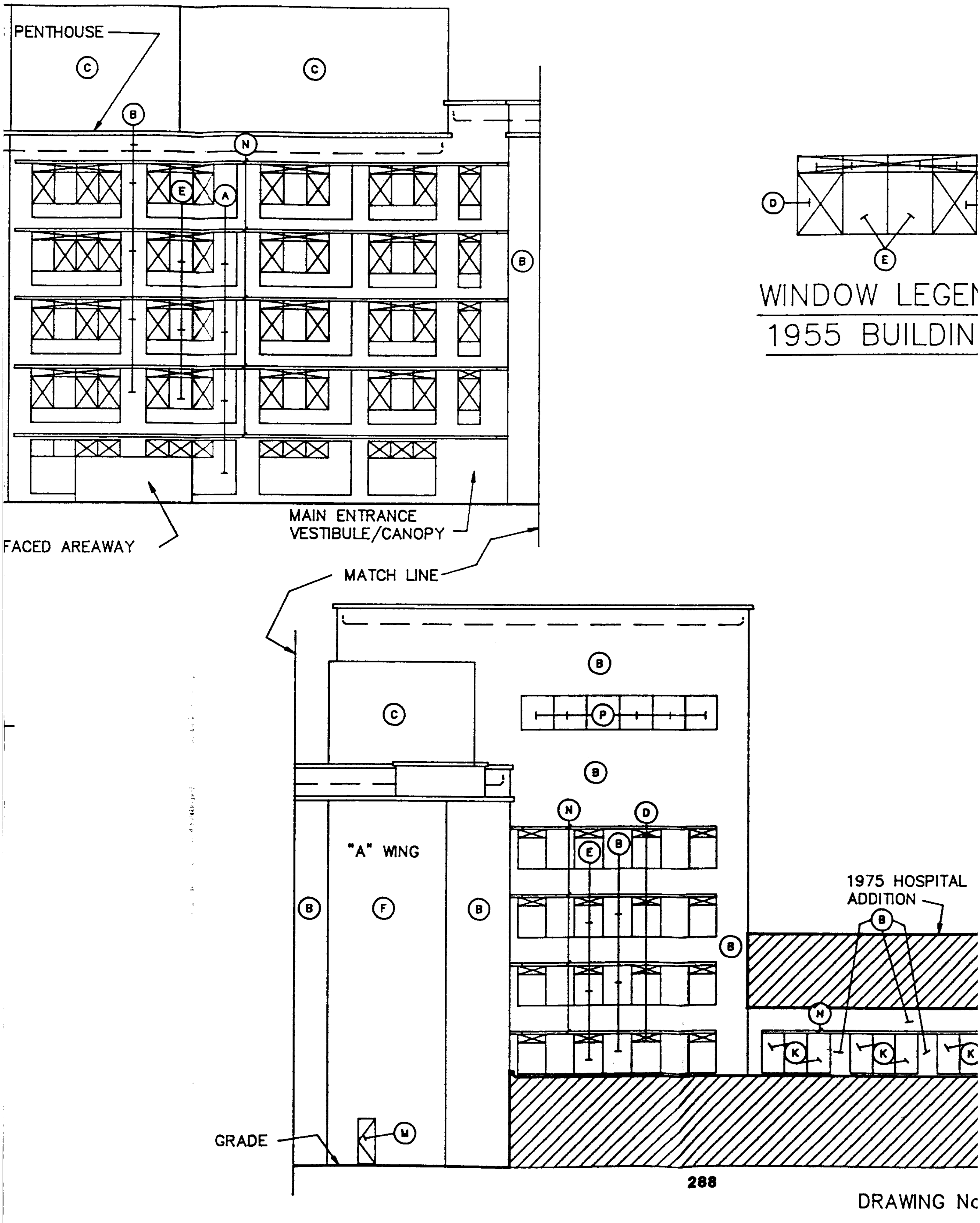


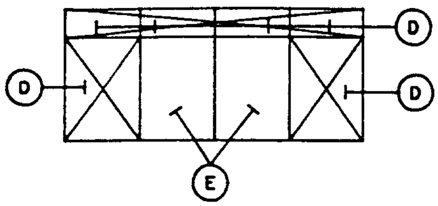
SOUTH ELEVATION

1955 BUILDING

1"=20'-0"

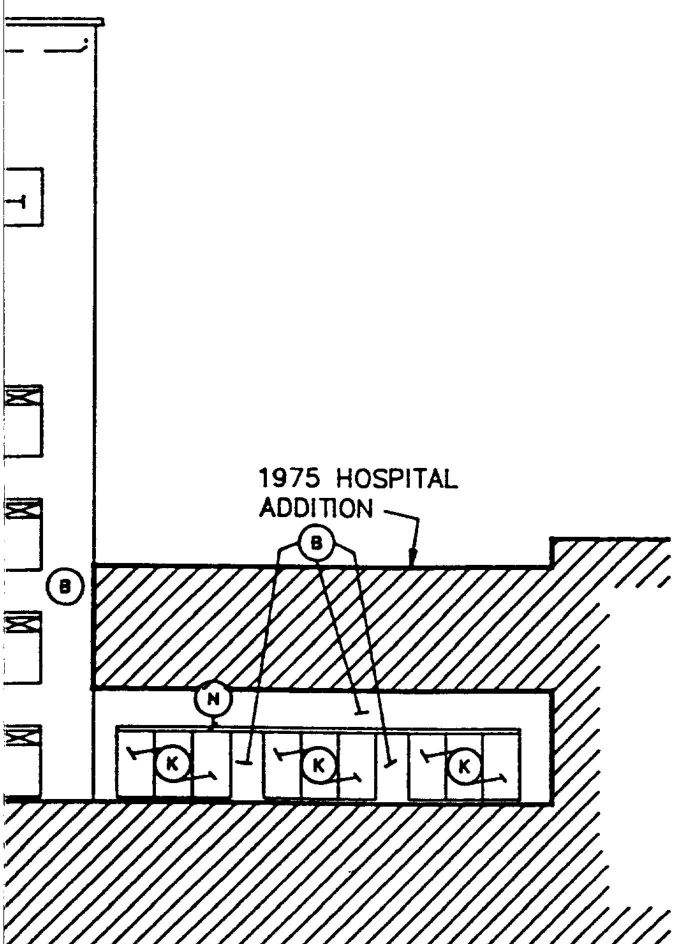


PENTHOUSE
FACED AREAWAY
MAIN ENTRANCE
VESTIBULE/CANOPY
MATCH LINE
WINDOW LEGEN
1955 BUILDIN
"A" WING
1975 HOSPITAL
ADDITION
GRADE
DRAWING Nc



WINDOW LEGEND

1955 BUILDING



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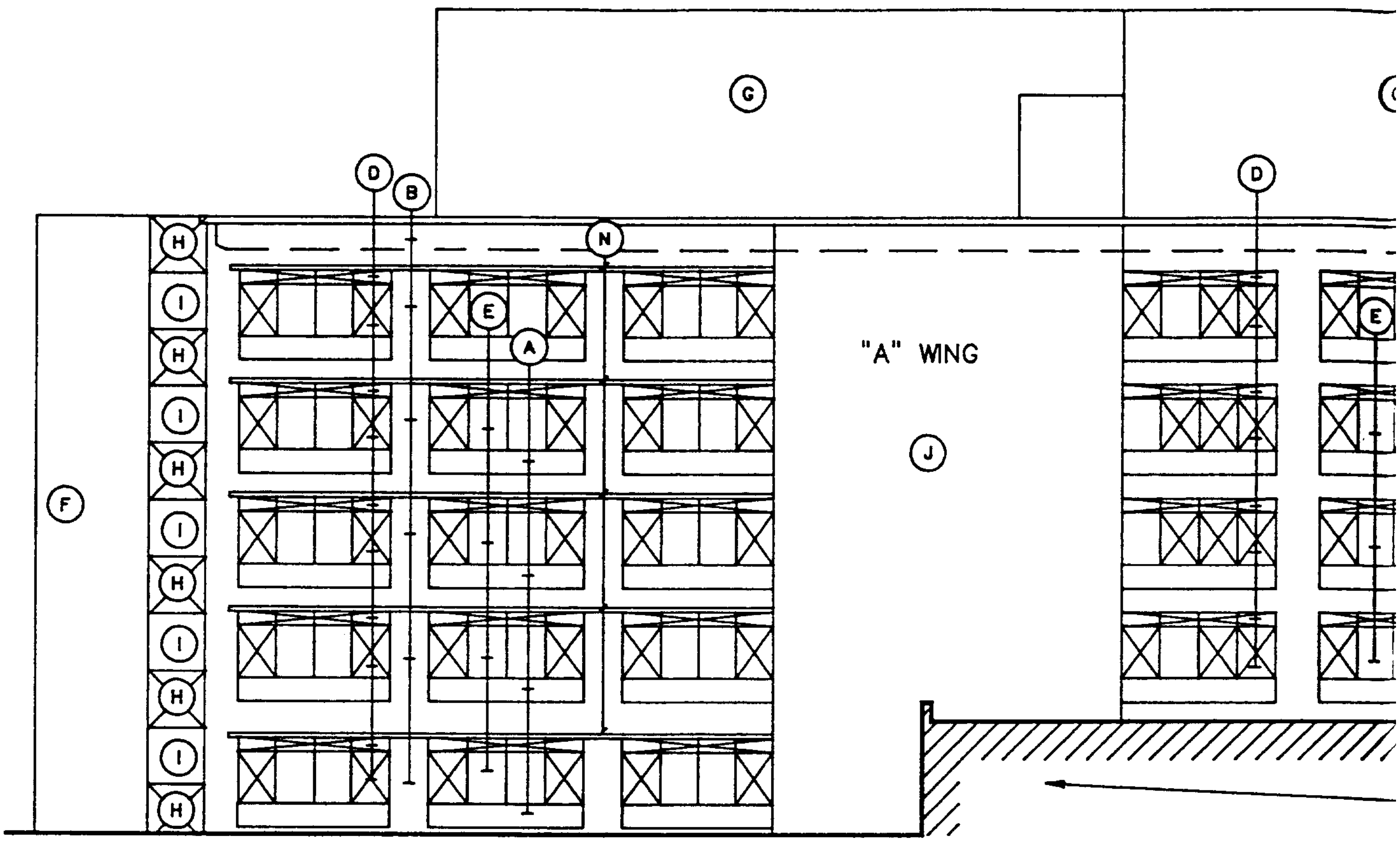
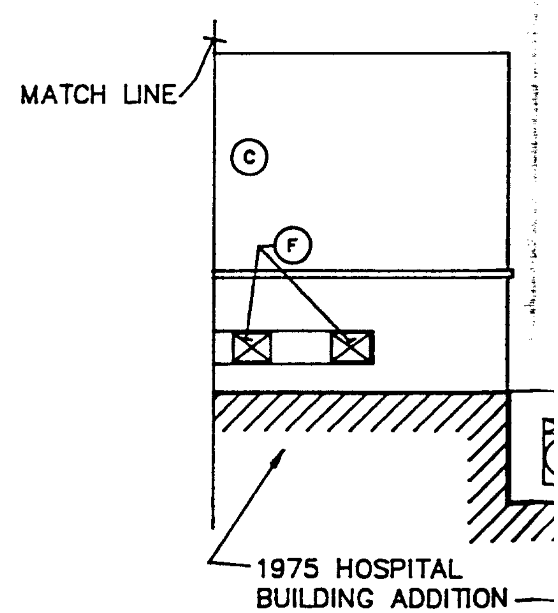


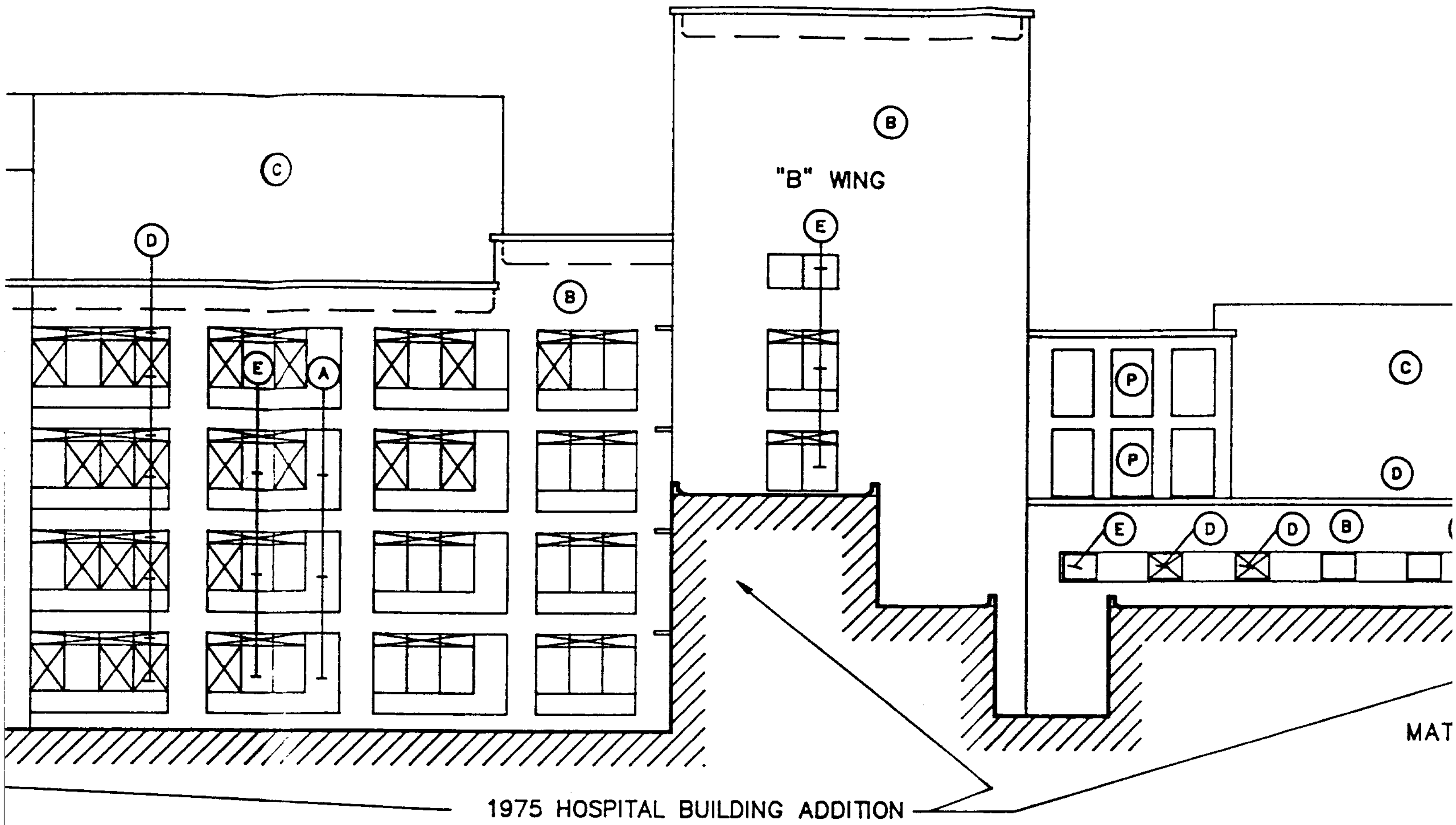
(SOUTH



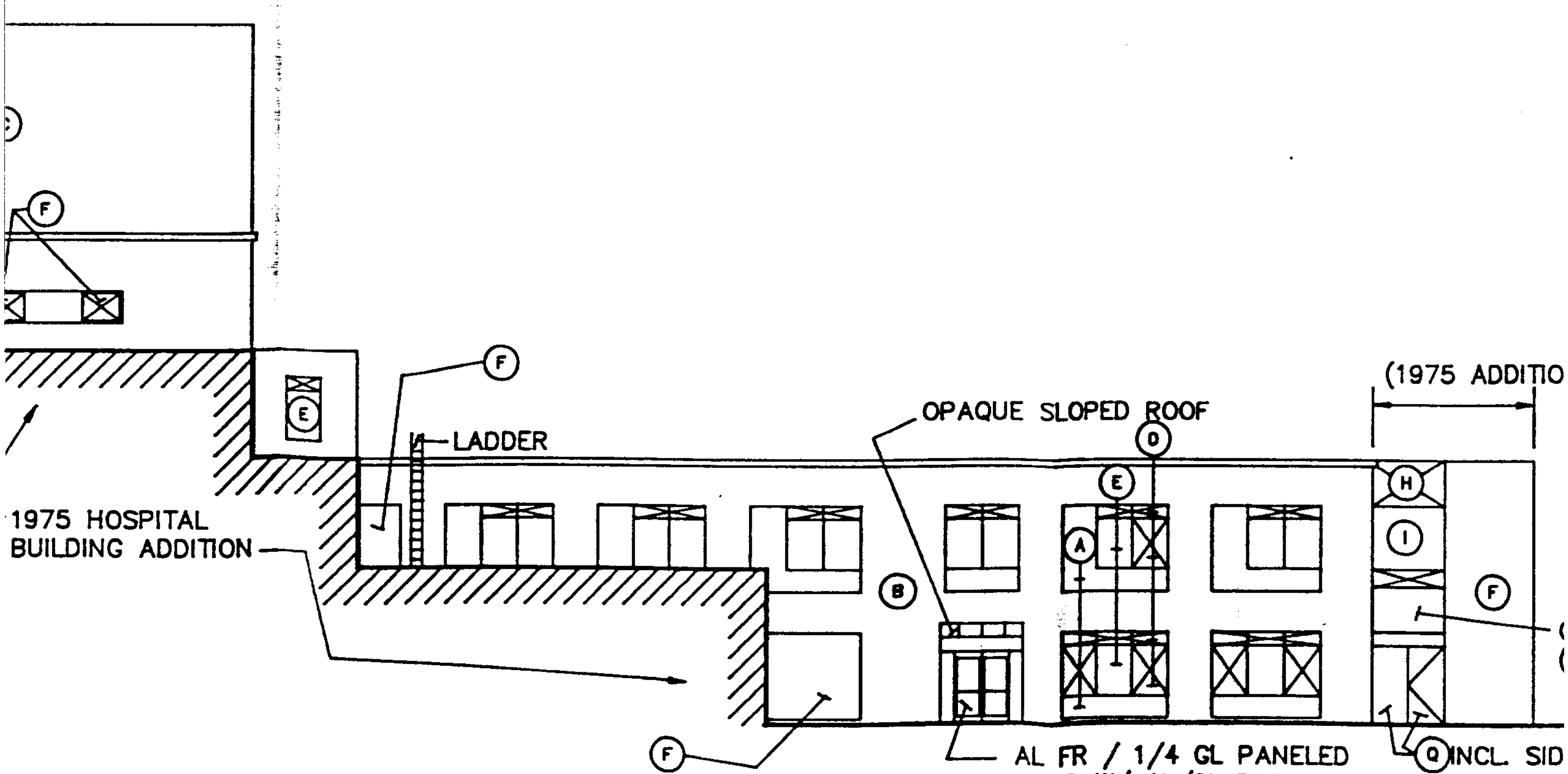
EAST ELEVATION

1955 BUILDING

1"=20'-0"

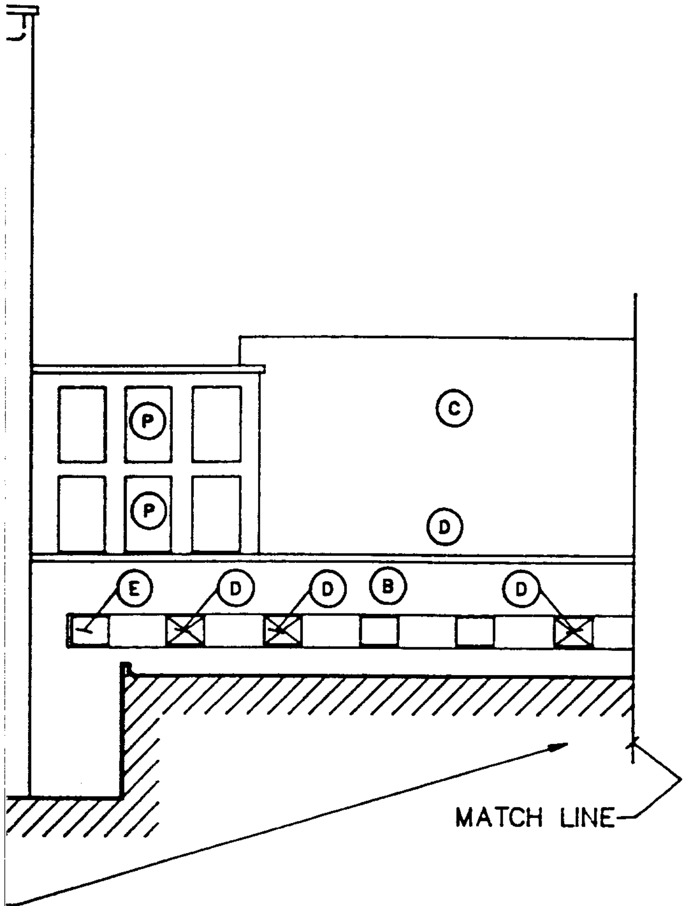


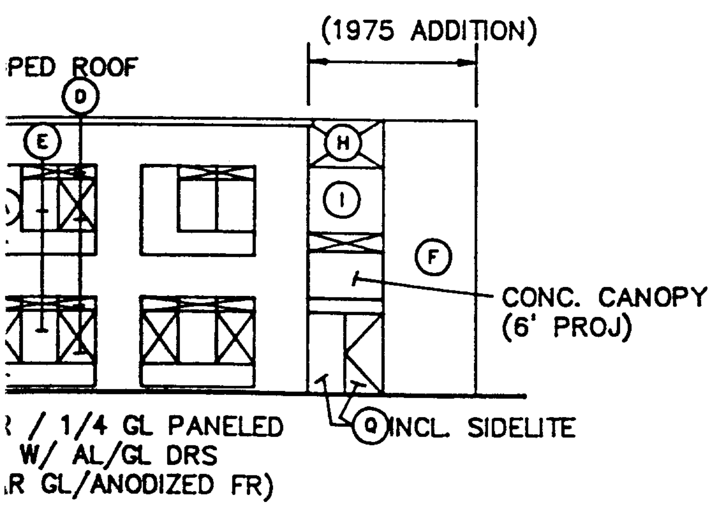
(SOUTH PORTION)



(NORTH PORTION)

DRAWING No





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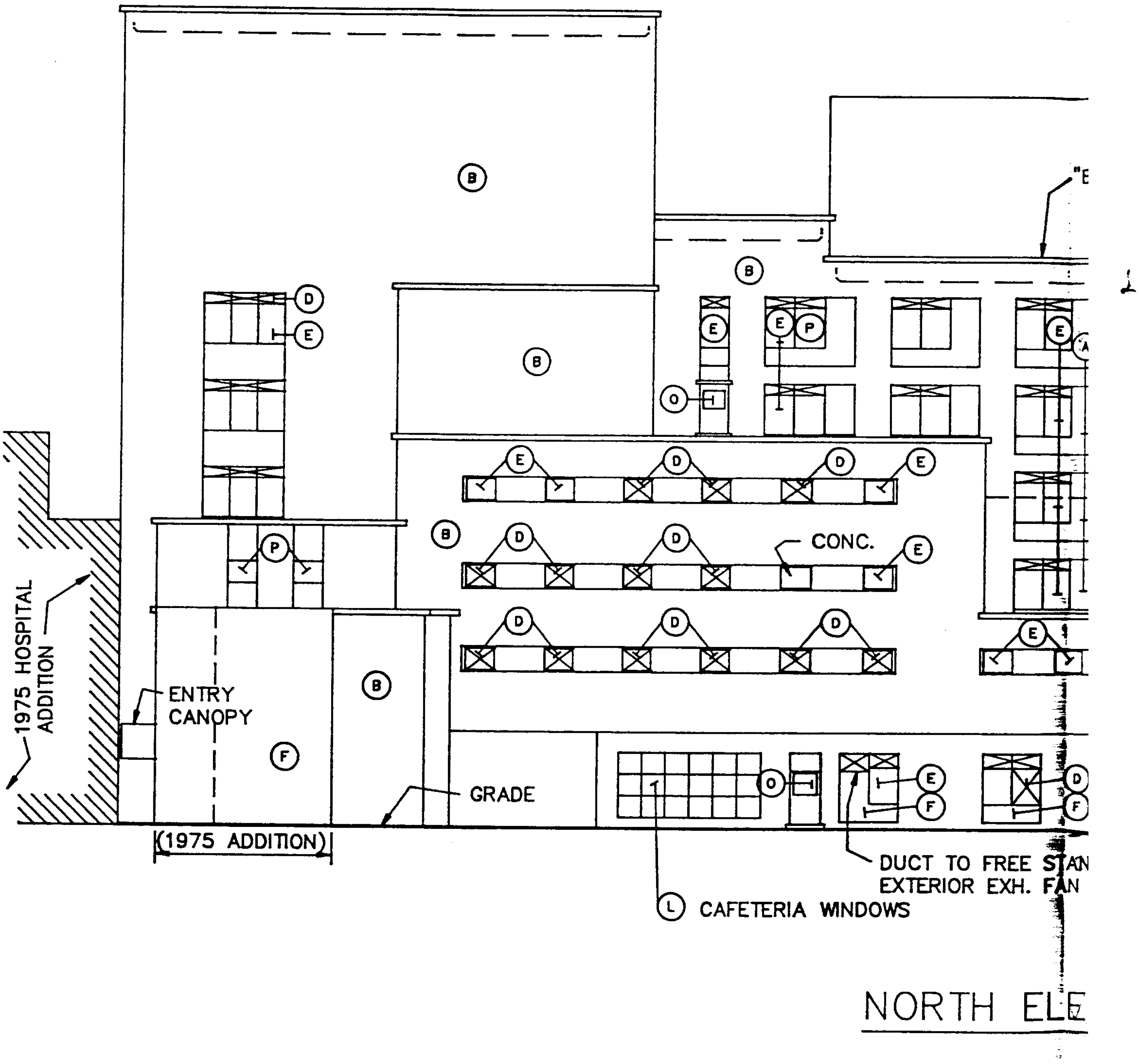
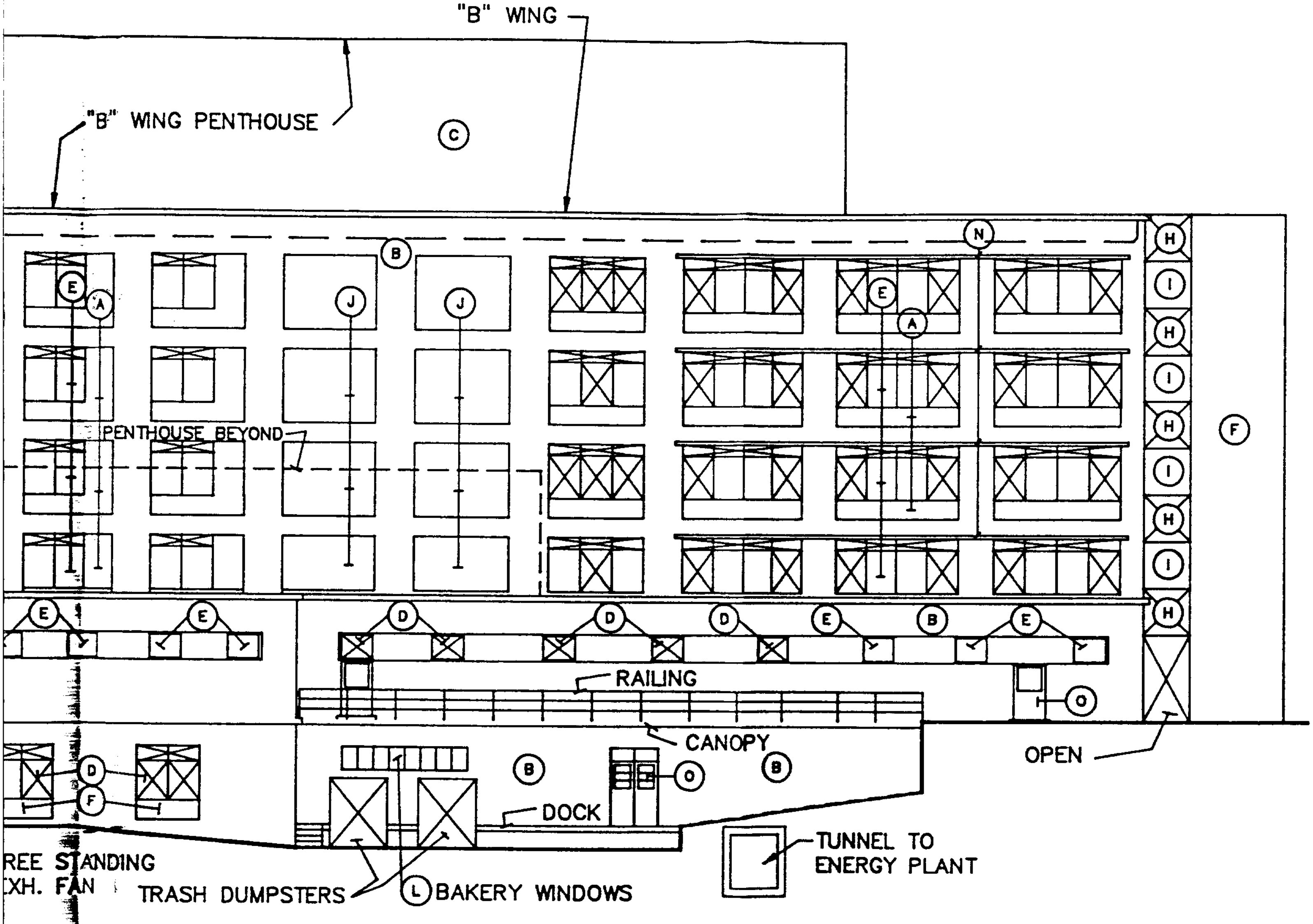


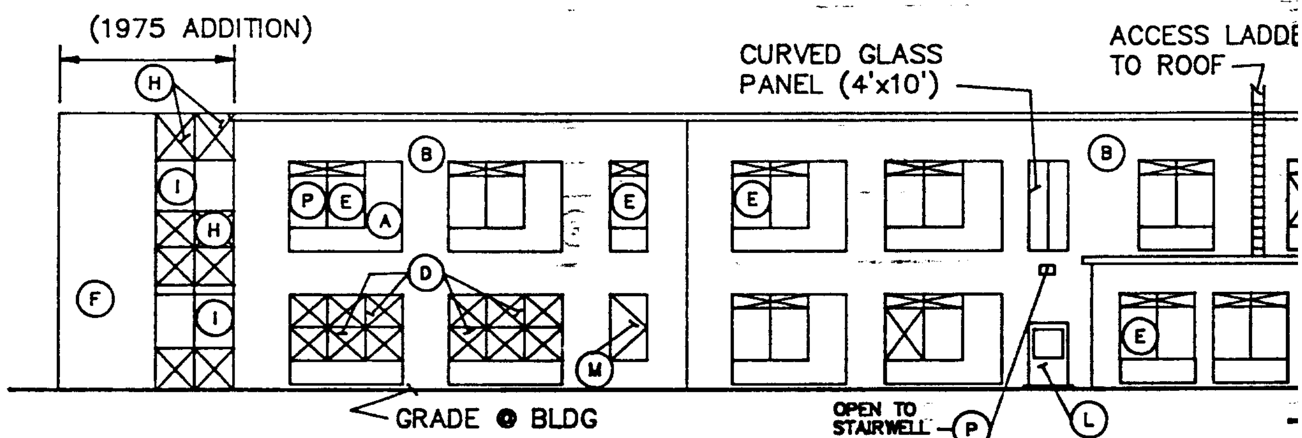
1955 BUILDING

1"=20'-0"

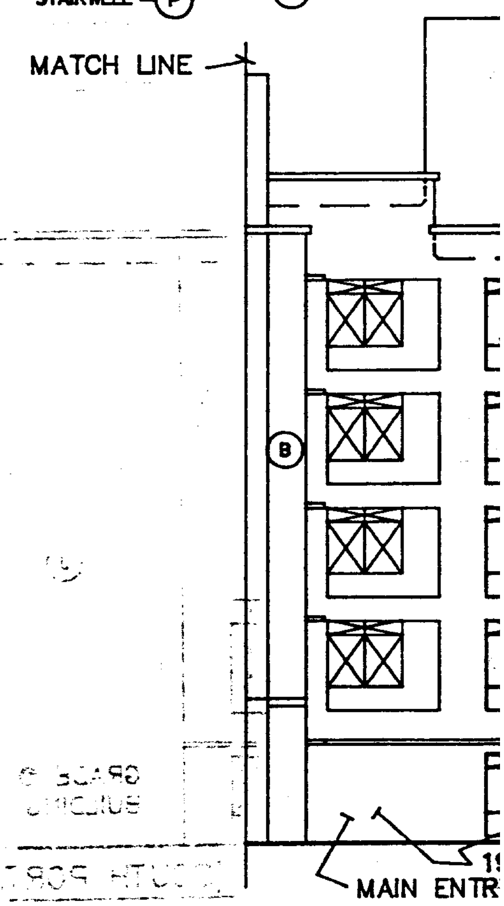


ELEVATION

DRAWING No. 6 OF

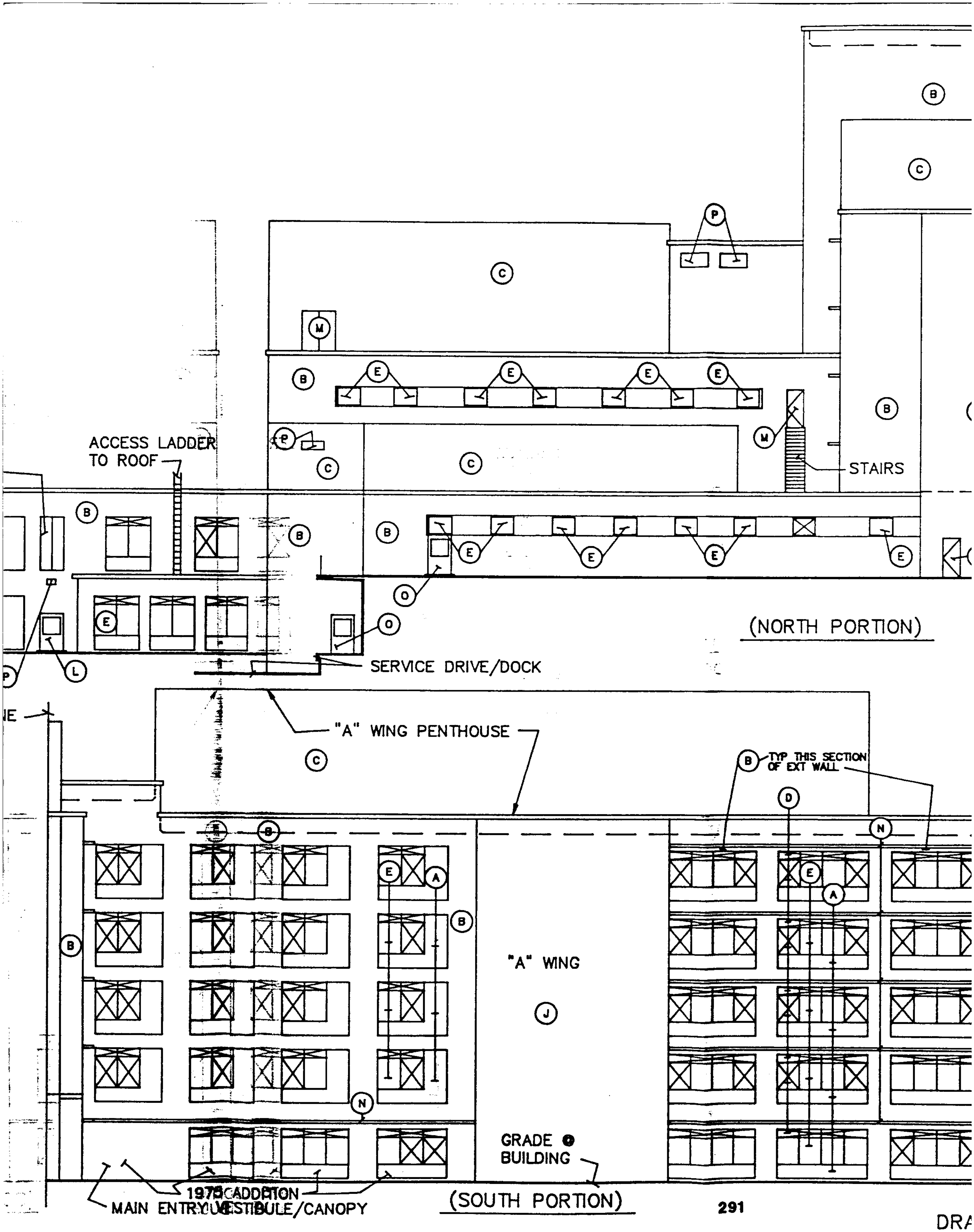


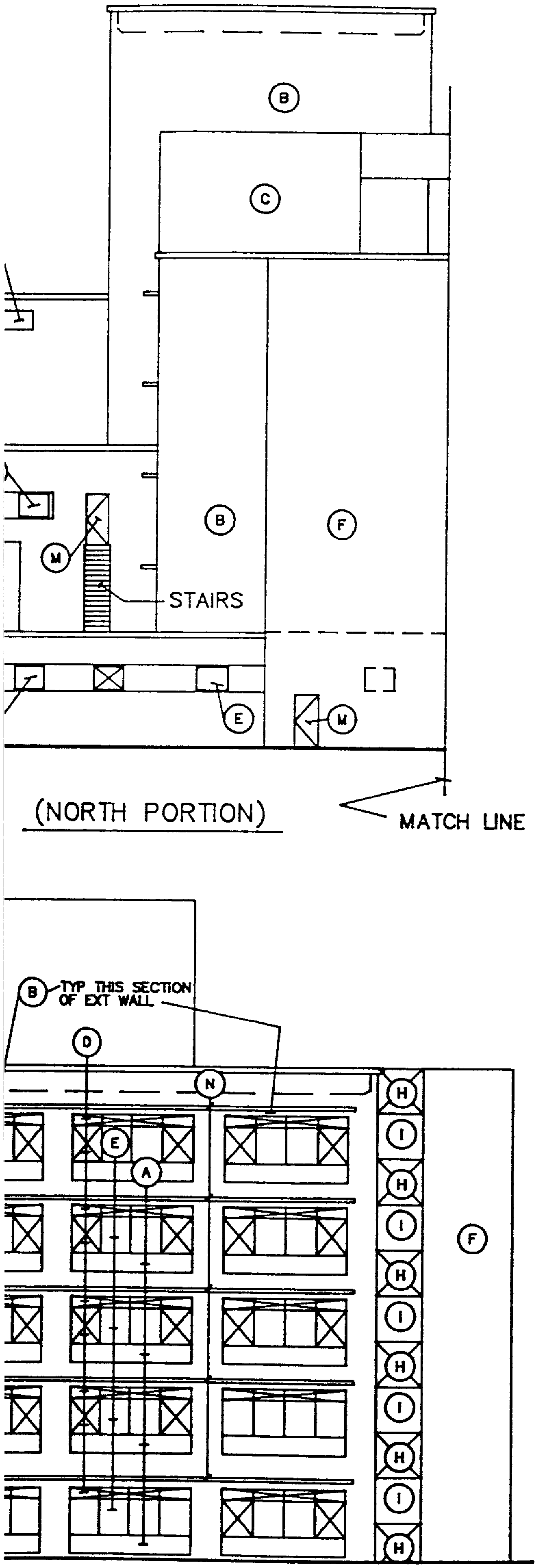
WEST ELEVATION



1955 BUILDING

1"=20'-0"


ACCESS LADDER TO ROOF
STAIRS
(NORTH PORTION)
SERVICE DRIVE/DOCK
"A" WING PENTHOUSE
TYP THIS SECTION OF EXT WALL
"A" WING
GRADE @ BUILDING
1975 ADDITION
MAIN ENTRY VESTIBULE/CANOPY
(SOUTH PORTION)



DRAWING No. 7 OF 7